

BAER and ES & R Treatments, Tools and Other Stuff



Pete Robichaud
Rocky Mountain Research Station
USDA Forest Service



WHAT A YEAR, 2014

- Monitoring Results
- BAER DB
- FS WEPP
- Technological Developments
 - Unburned soils in ERMiT
 - Online GIS WEPP
 - Geo-WEPP
 - Ravel Rat
 - 6 pubs
- *Continued Monitoring*
 - 2011 Wallow Fire, AZ
 - 2012 High Park Fire, CO
- *New Sites*
 - 2013 Rim Fire, CA
 - 2014 Preacher Fire, ID wind

Burned Area Emergency Response (BAER) Tools

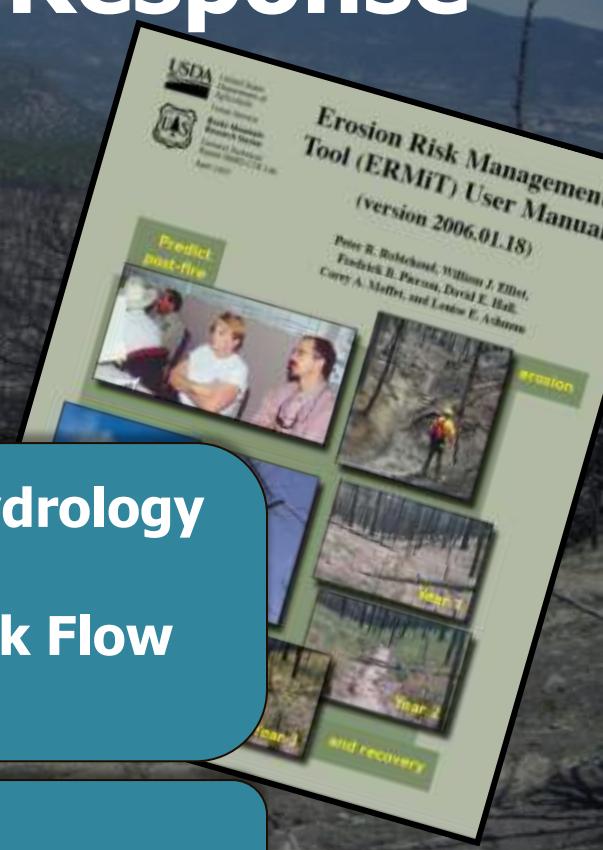
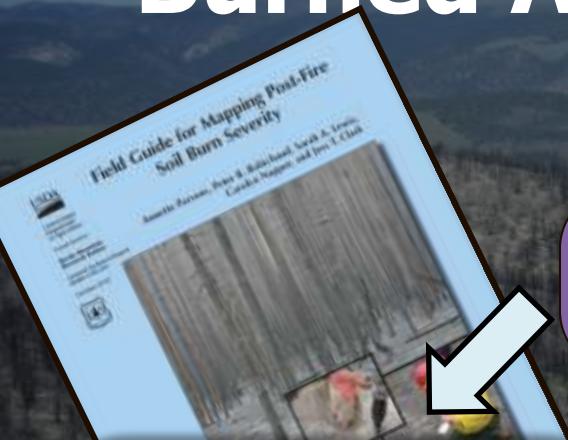
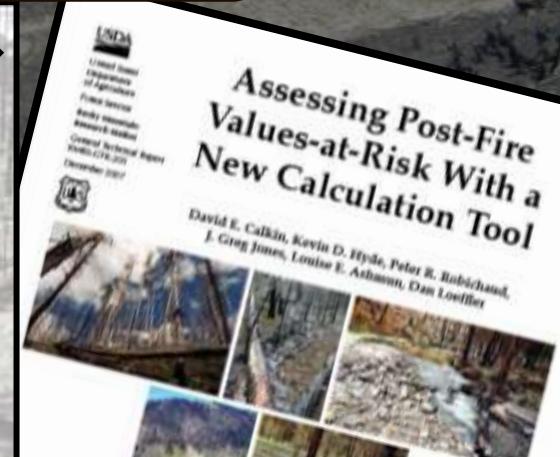
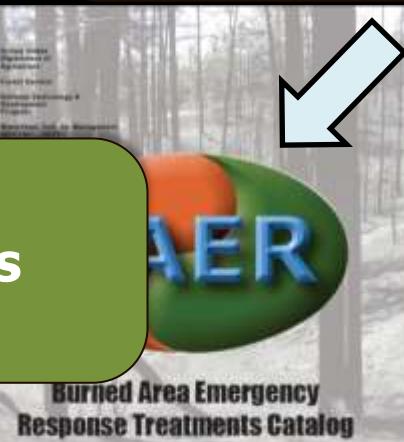
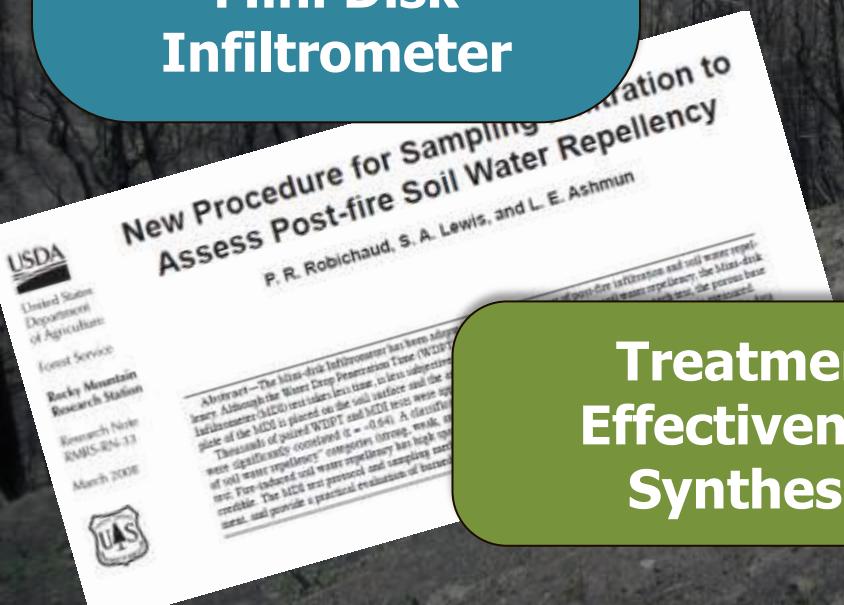
Remote Sensing Imagery

Soil Burn Severity Guide
Mini Disk Infiltrometer

Erosion/Hydrology Predictions
ERMiT, Peak Flow Calculator

VAR Tools

Treatment Effectiveness Synthesis



Evaluating Rehabilitation Treatments

United States
Department of Agriculture
Forest Service
Rocky Mountain
Research Station
General Technical
Report RMRS-GTR-43
September 2000

Evaluating the Effectiveness of Postfire Rehabilitation Treatments

Peter R. Robichaud
Jan L. Beyers
Daniel G. Neary

2000



United States
Department of
Agriculture
Forest Service



Rocky Mountain
Research Station

General Technical
Report RMRS-GTR-228

A Synthesis of Post-Fire Road Treatments for BAER Teams: Methods, Treatment Effectiveness, a Decisionmaking Tools for f

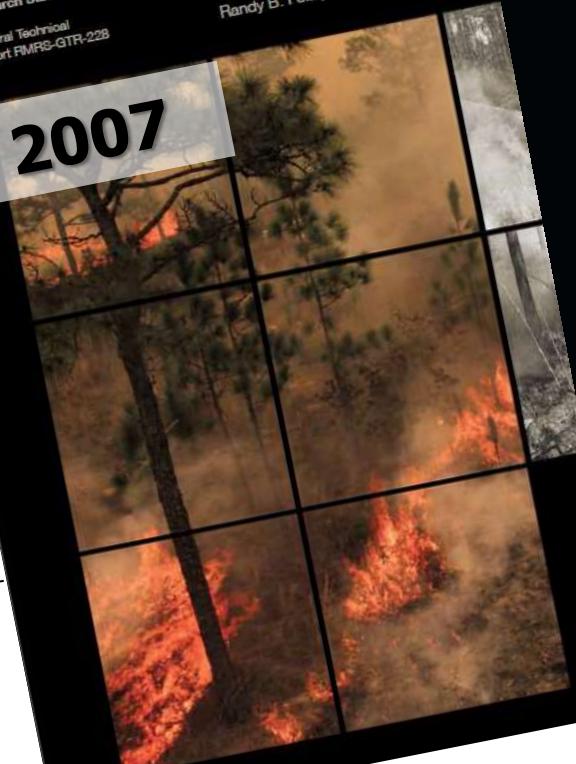
Randy B. Foltz, Peter R. Robichaud, an

United States
Department of Agriculture
Forest Service
Rocky Mountain
Research Station
General Technical
Report RMRS-GTR-240
August 2010

Post-Fire Treatment Effectiveness for Hillslope Stabilization

Peter R. Robichaud, Louise E. Ashmun, and Bruce D. Sims

2007



2010



Evaluating Rehabilitation Treatments



Evaluating the Effectiveness of Postfire Rehabilitation Treatments

		Straw mulches	Wood mulches	Hydro-mulches	Soil binders (PAM)	Contour-felled logs (LEBs)	Straw wattles
Overall effectiveness rating (1, 2, or 3)	High intensity rainfall (>2-yr return interval)	1	1	3	3	3	3
	Low intensity rainfall	1	1	1	2	1	1
	High rainfall amount (>50 mm in 6 hr)	1	1	2	3	2	2

	Remains functional for more than one year	more	more	less	less	more	more
	Provides ground cover	more	more	more	less	less	less
	Traps sediment	more	more	less	less	more	more



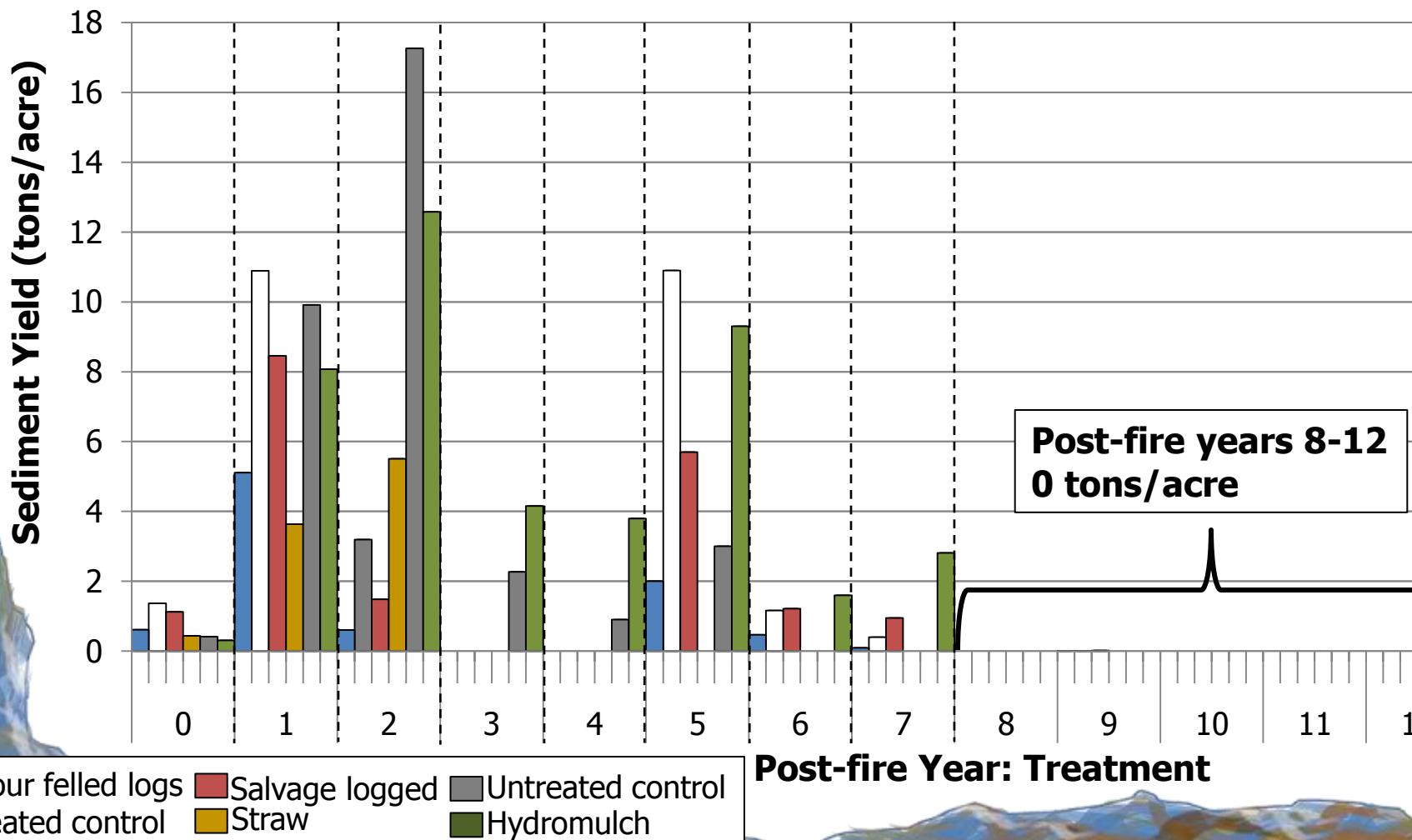
2002 HAYMAN FIRE

WATERSHED TREATMENT MONITORING

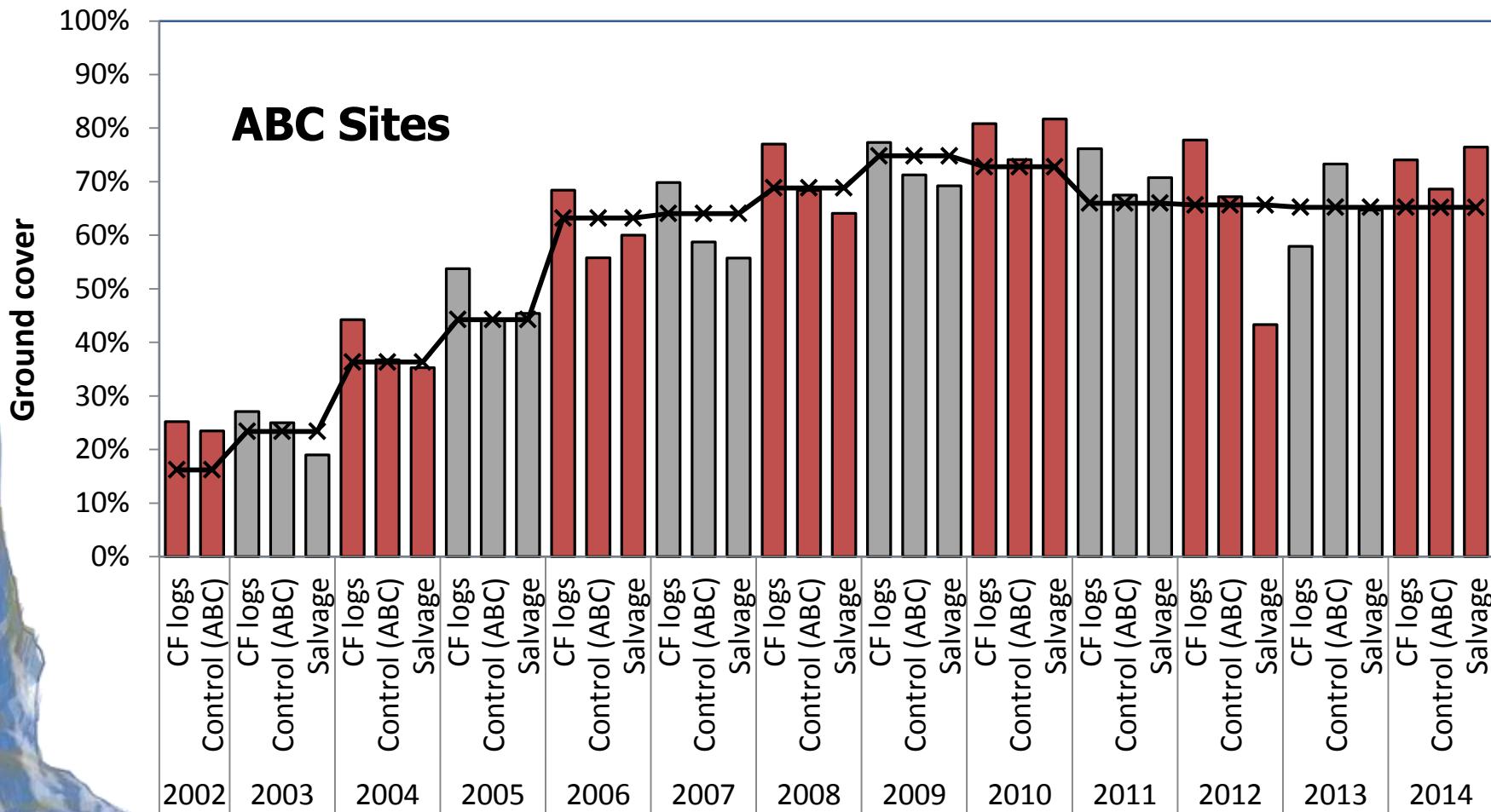
12 Years after the Fire



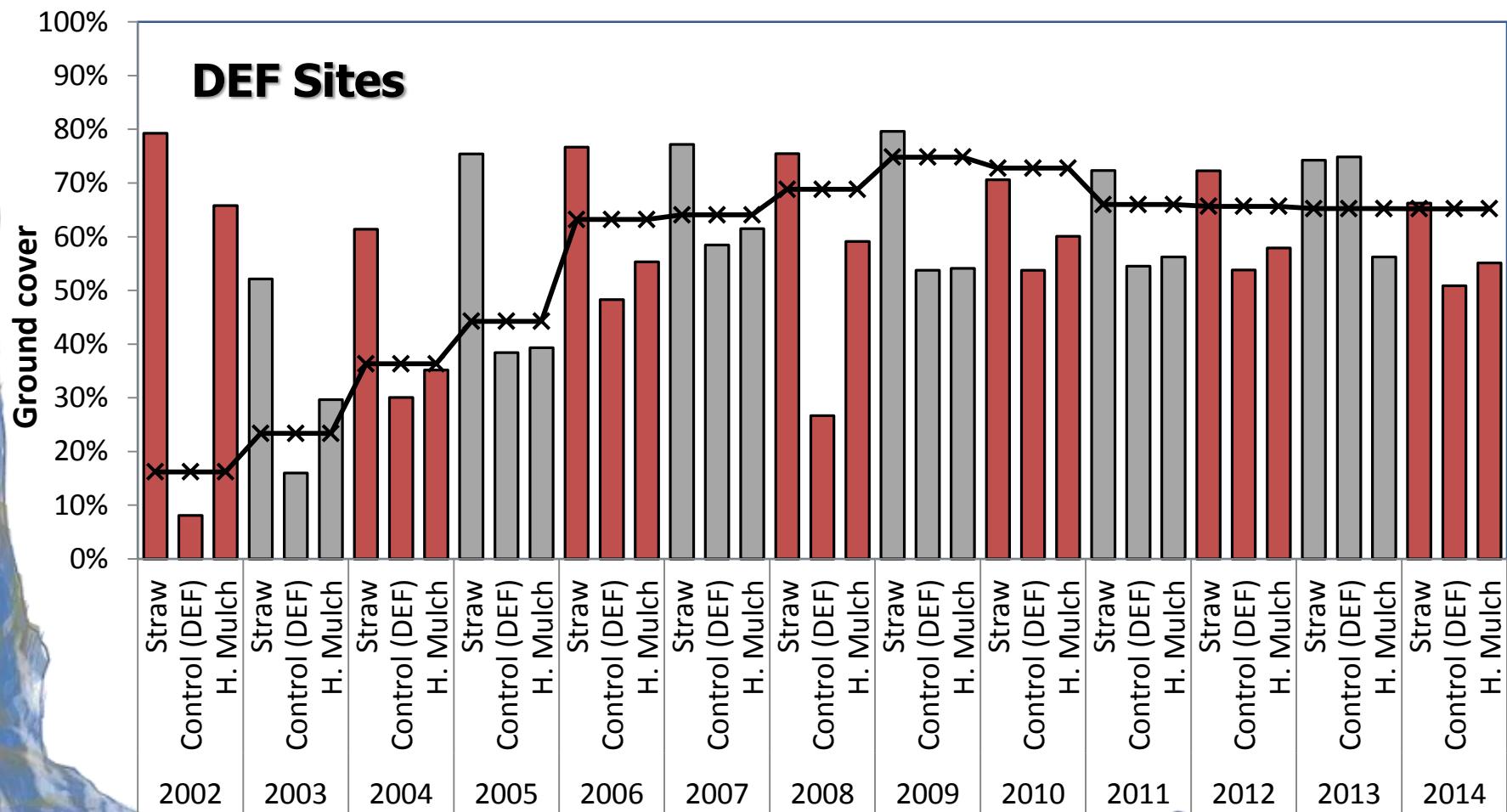
HAYMAN ANNUAL SEDIMENT YIELDS

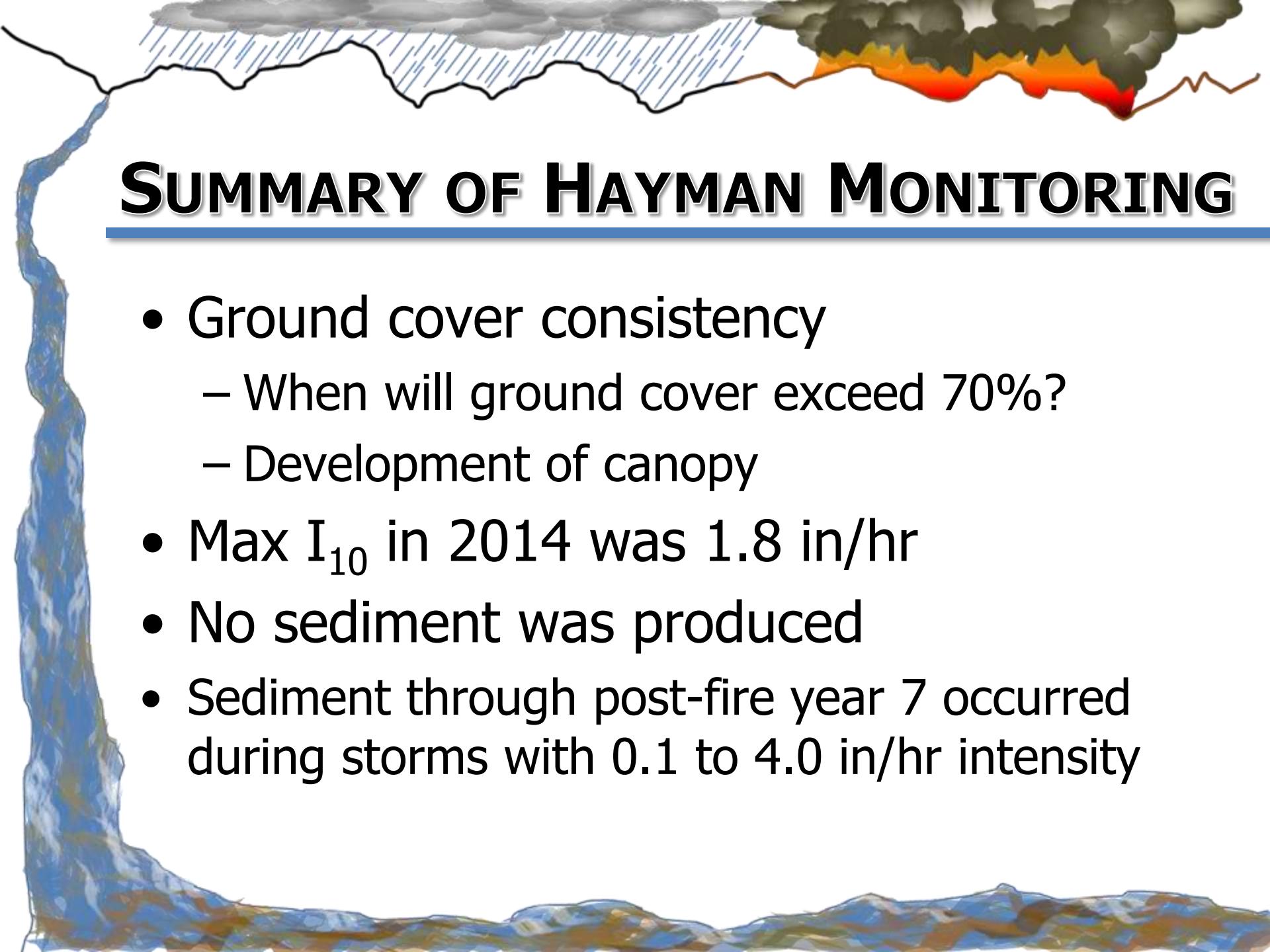


HAYMAN GROUND COVER 2002-2014



HAYMAN GROUND COVER 2002-2014



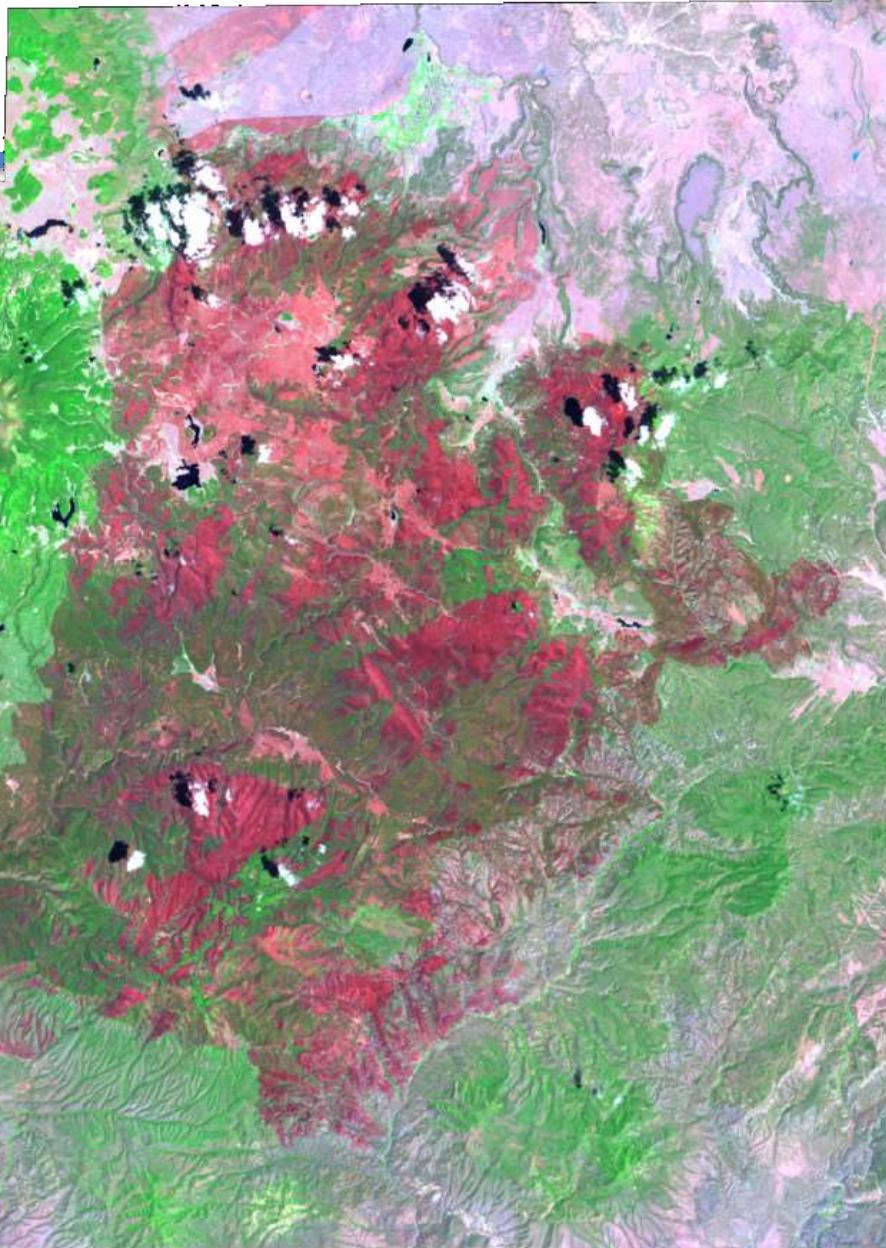


SUMMARY OF HAYMAN MONITORING

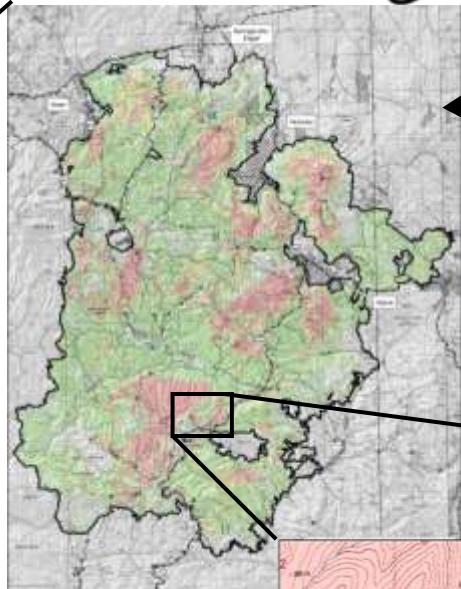
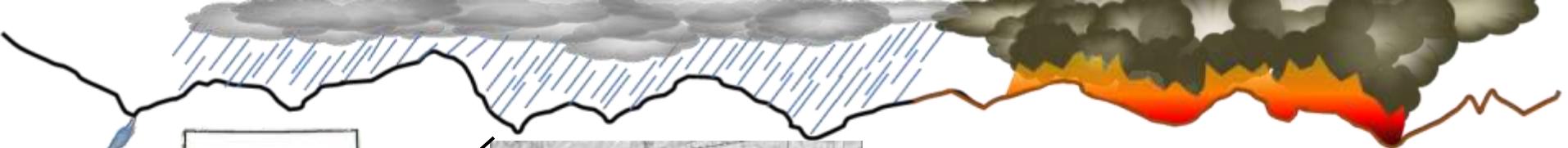
- Ground cover consistency
 - When will ground cover exceed 70%?
 - Development of canopy
- Max I_{10} in 2014 was 1.8 in/hr
- No sediment was produced
- Sediment through post-fire year 7 occurred during storms with 0.1 to 4.0 in/hr intensity

WALLOW FIRE

AZ, 2011

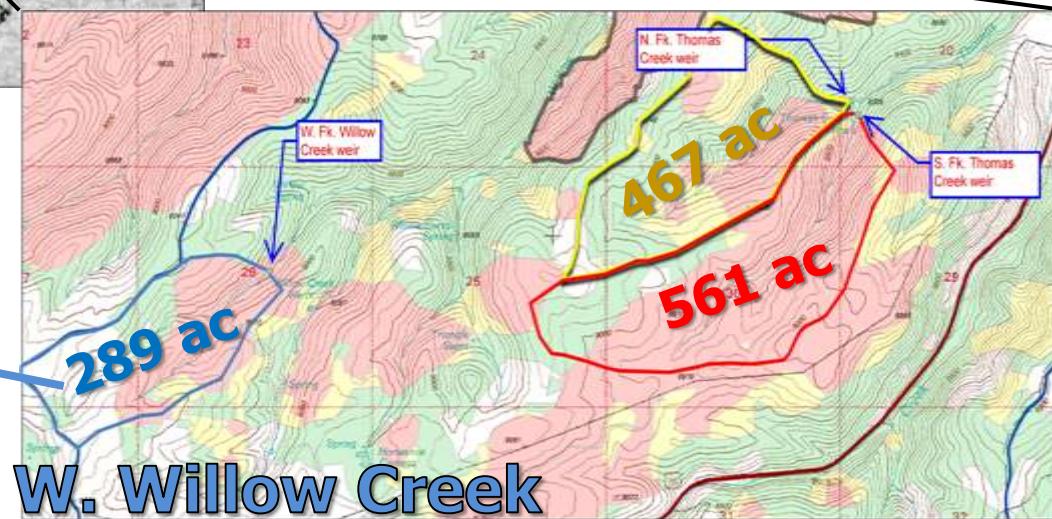
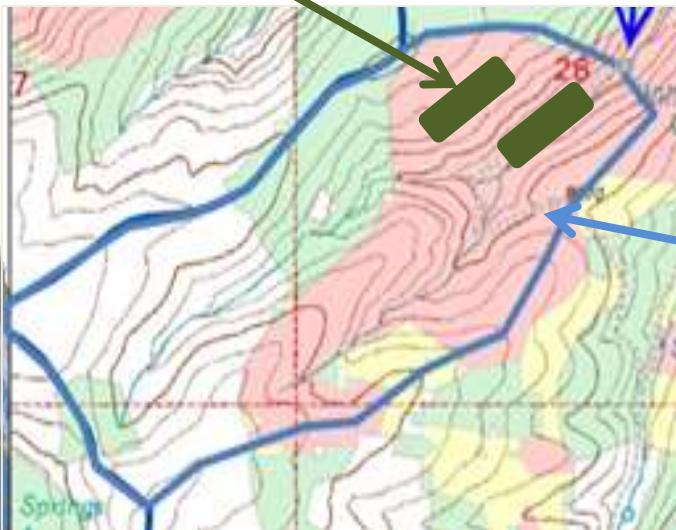


*Map is from Red
Application Center



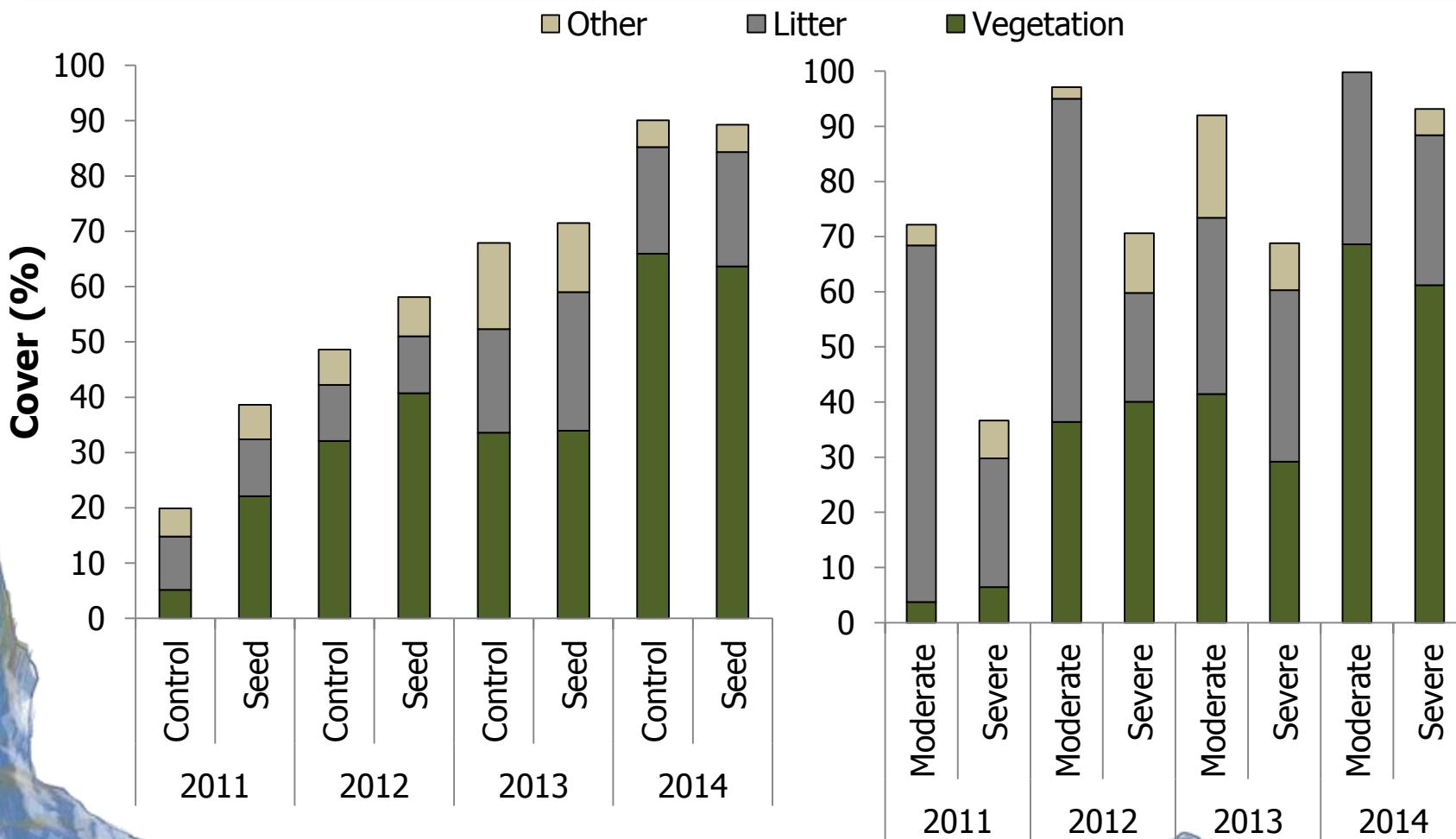
**2011 Wallow Fire
536,000 ac**

Seeded plots



W. Willow Creek

WALLOW GROUND COVER



WALLOW GROUND COVER PROGRESSION

CONTROL
SEEDED

AUG 2011



JUNE 2012



JUNE 2013



AUG 2014



CONTROL
SEEDED

AUG 2011



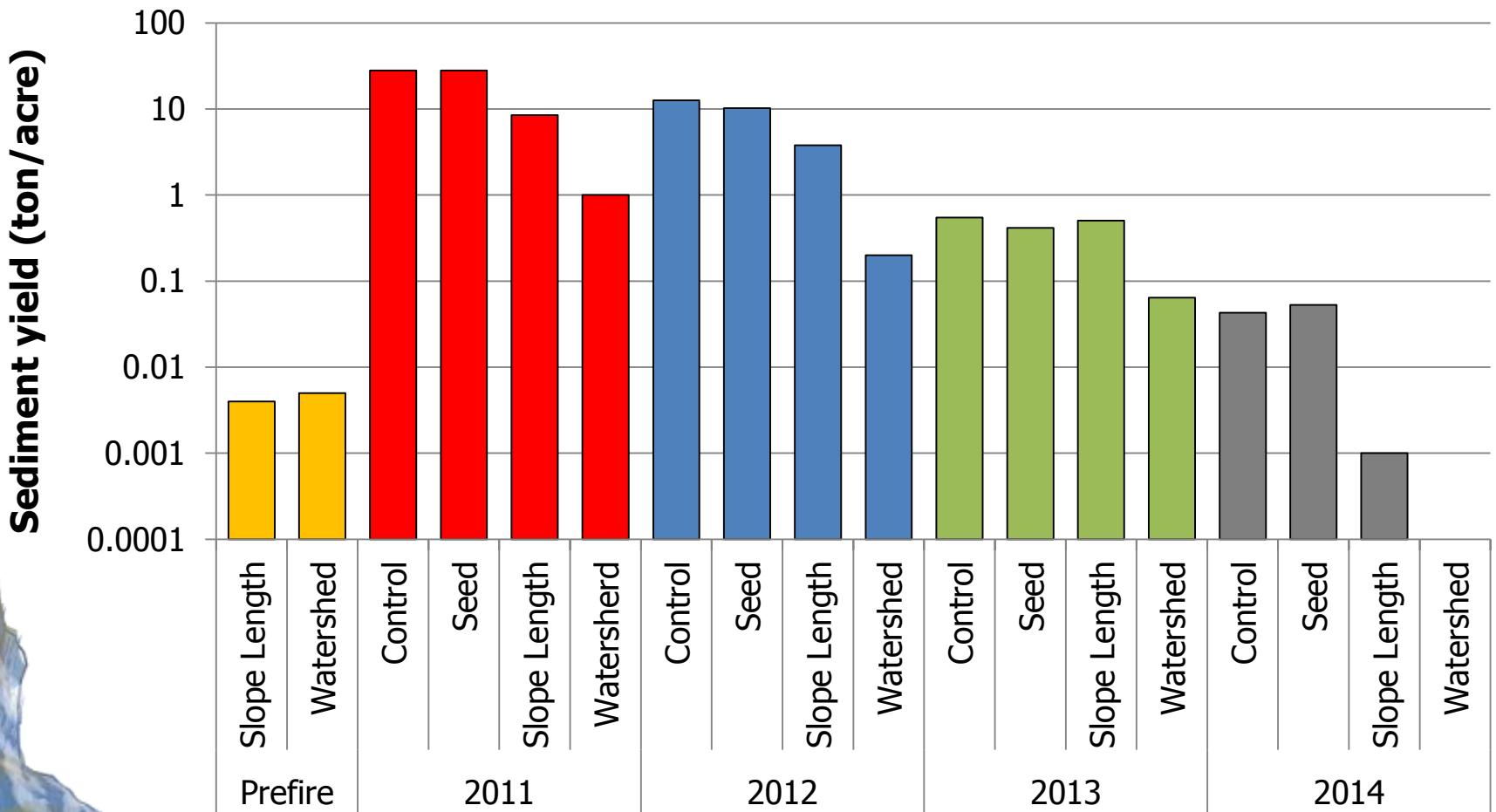
JUNE 2012

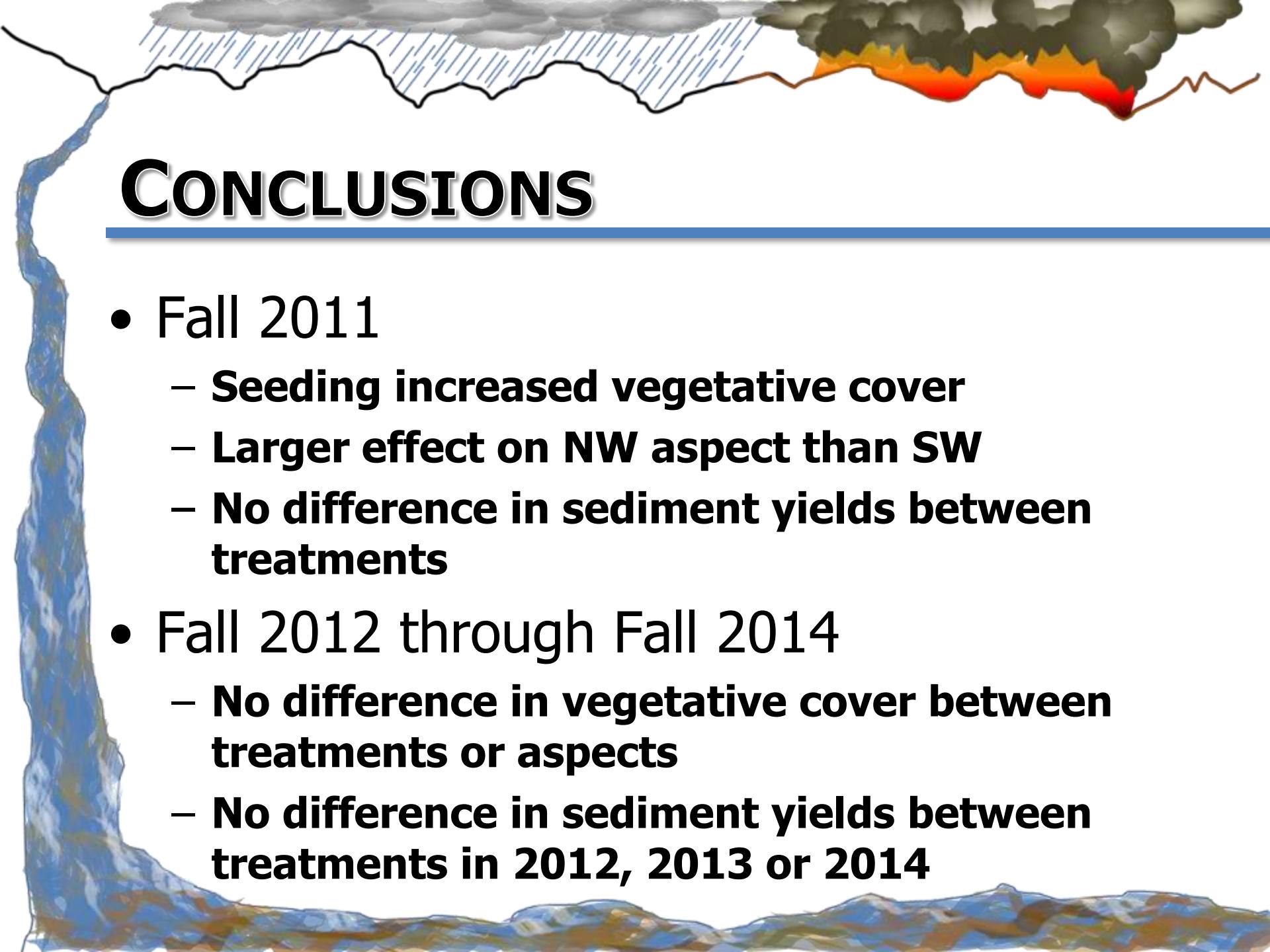


JUNE 2013



WALLOW SEDIMENT, 2014





CONCLUSIONS

- Fall 2011
 - **Seeding increased vegetative cover**
 - **Larger effect on NW aspect than SW**
 - **No difference in sediment yields between treatments**
- Fall 2012 through Fall 2014
 - **No difference in vegetative cover between treatments or aspects**
 - **No difference in sediment yields between treatments in 2012, 2013 or 2014**

TWITCHELL CANYON FIRE

Straw Bale Check Dams Effectiveness

- 2010 - 2014

**Twitchell Canyon
Fire**

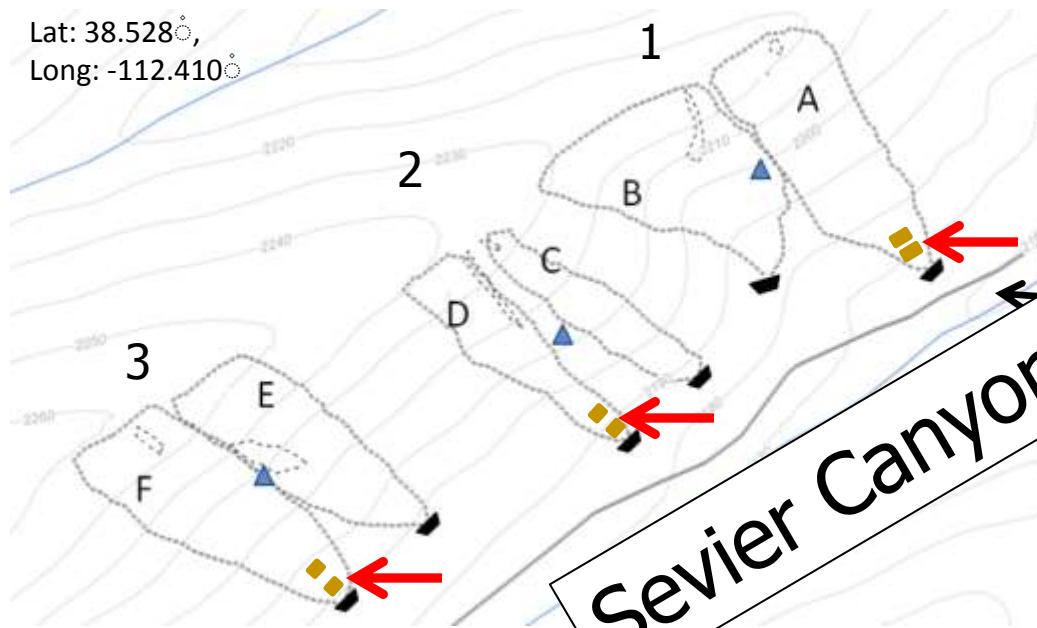
44874 ac

Site Elevation: 7380 ft

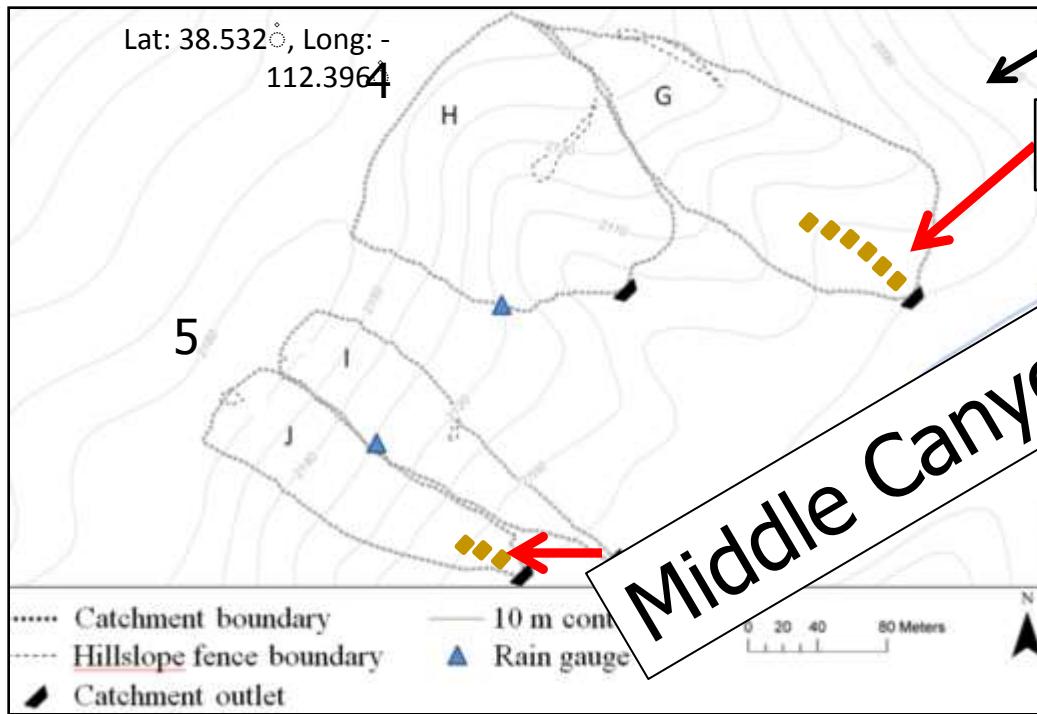
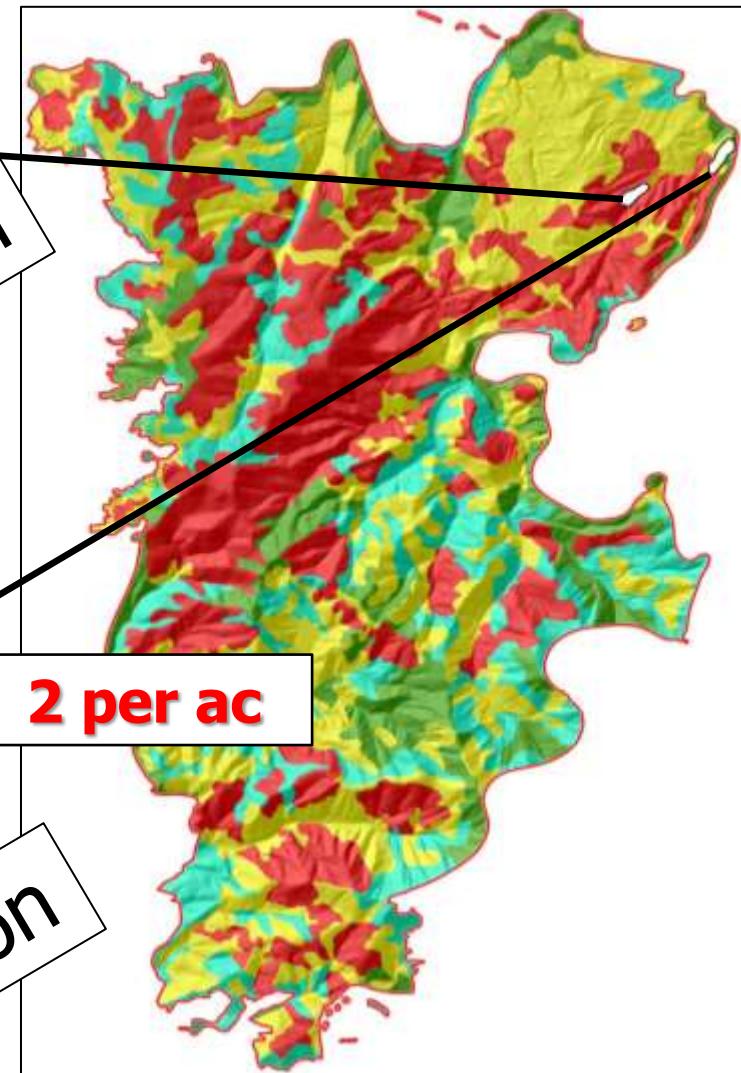
Average rainfall: May-Sep: 9.5 "



Lat: 38.528°,
Long: -112.410°



Sevier Canyon



Middle Canyon

..... Catchment boundary
- - - Hillslope fence boundary
▲ Rain gauge
◆ Catchment outlet

— 10 m contour
0 20 40 60 Meters
N

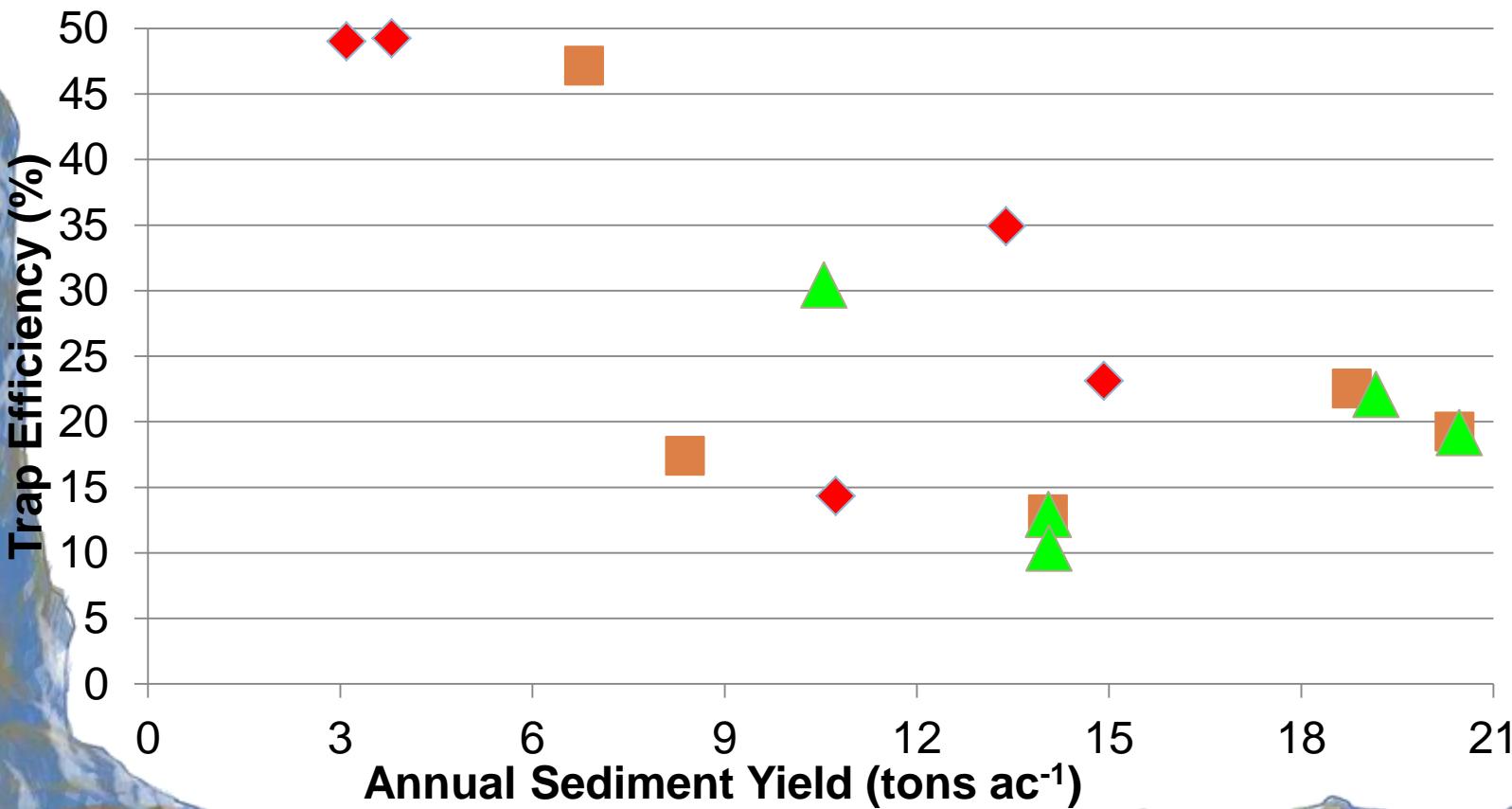
TRAPPED SEDIMENT

- **Treatment Rate:**
2 strawbale checkdams/ac
 - **1st year: 2.6 tons ac⁻¹ (1.5-4.7)**
 - **3rd year: 2.9 tons ac⁻¹ (1.5-4.2)**



ANNUAL DECREASE IN TRAP EFFICIENCY

Decreases with increasing total sediment yield



STRAWBALE CHECKDAMS

TREATMENT CONSIDERATIONS



- Treatment rate
- Underlying geology
 - Channel stability
- Channel gradient
- Channel shape
 - (U or V shaped)
- Storm intensity /
Erosion potential

2012 HIGH PARK FIRE, CO

- Do BAER treatments influence soil N availability for plant growth?
- Microbial processing of soil organic matter
- What are drivers?
 - Decomposition – fast or slow?
 - Mulch quality (C:N, labile C)
 - Physical changes
 - Increased moisture



MULCH TYPES

WoodStraw®
(1.3-2 kg/ha)



Ag/Wheat Straw
0.4-0.6 kg/ha



Wood Shreds
(1.3-2 kg/ha)



Rubber Mulch
70% cover



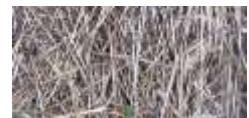
MONITORING PLANT N AVAILABILITY

- Expect **rapid initial** immobilization in fastest-decomposing mulch (highest quality)
- **Slower**, but longer lasting N immobilization in high C:N material (wood)

Lowest N availability



Ag Straw



Wood Shreds

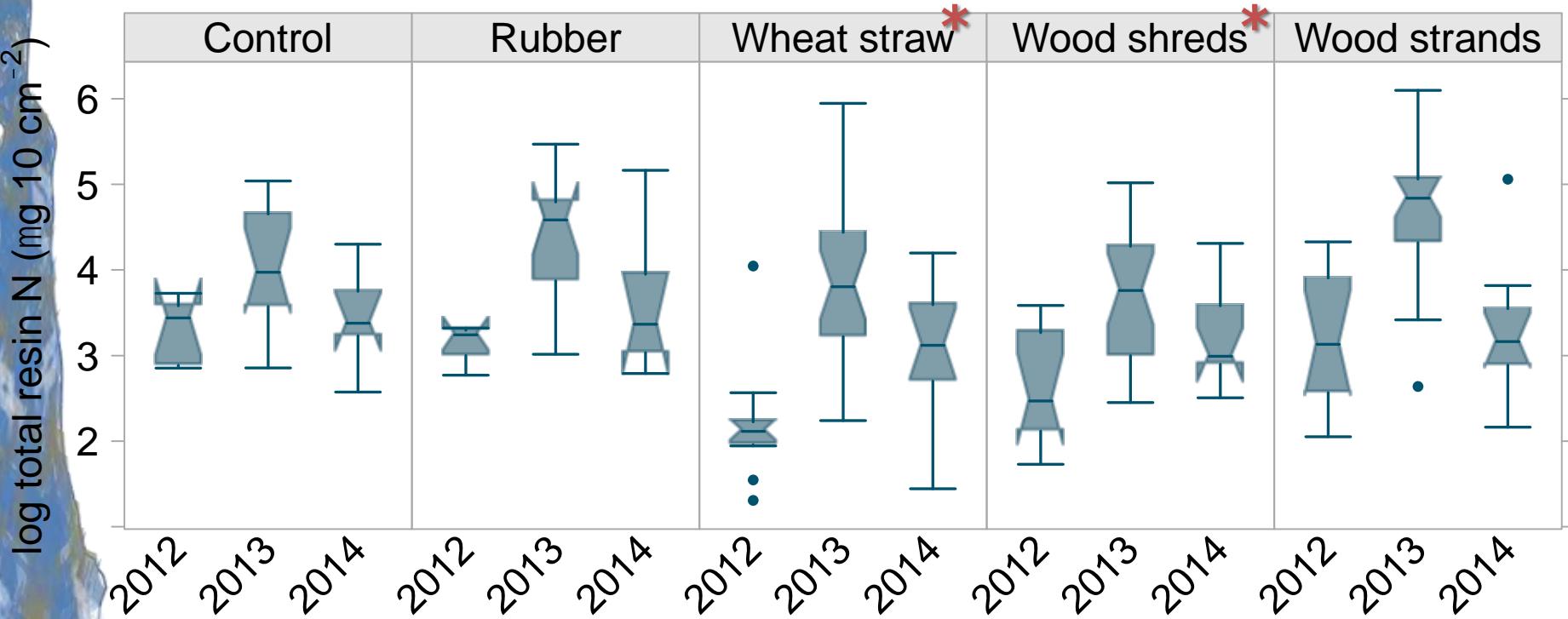


Wood Strands



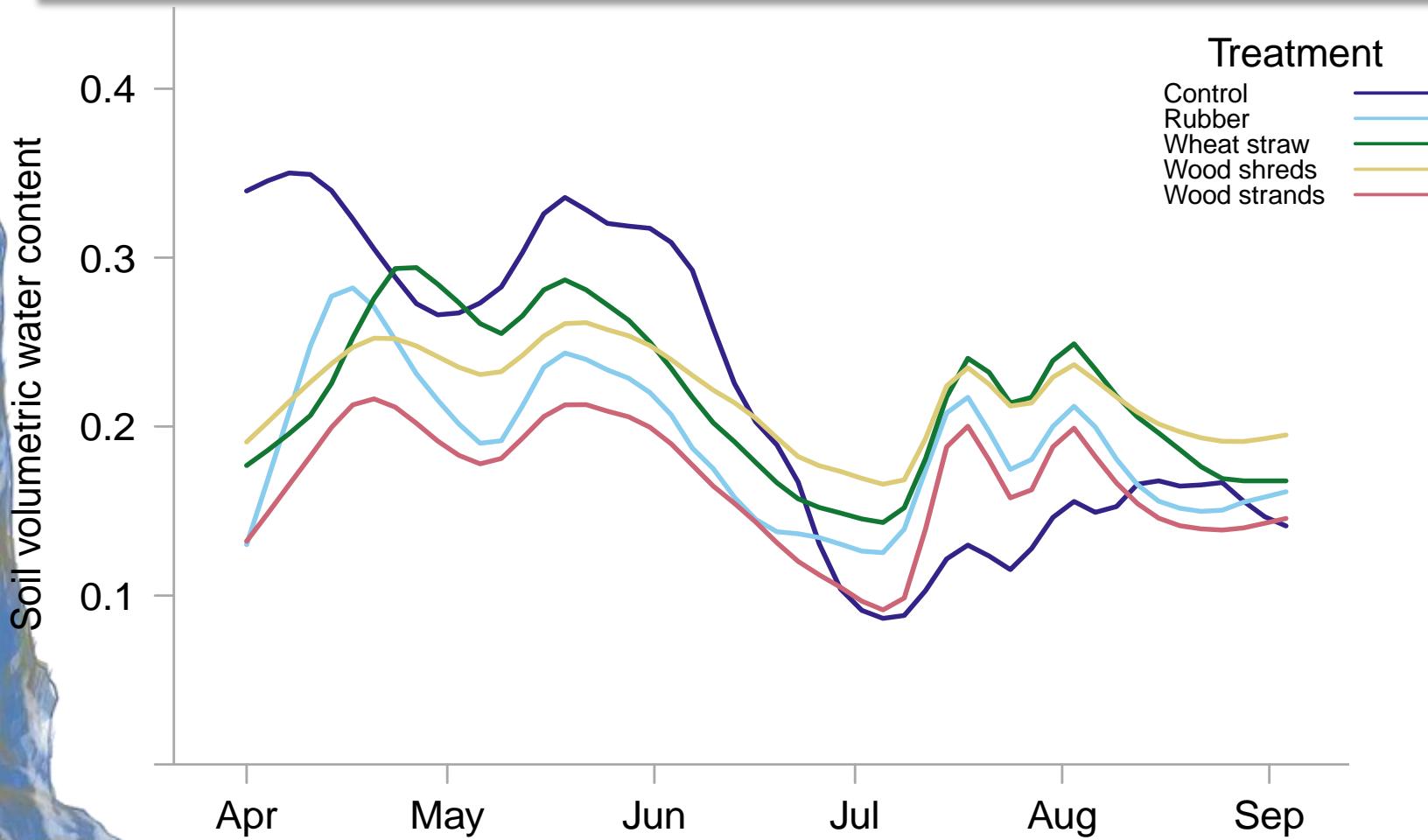
Most N availability

PLANT-AVAILABLE N WAS REDUCED BY WHEAT AND WOOD SHREDS



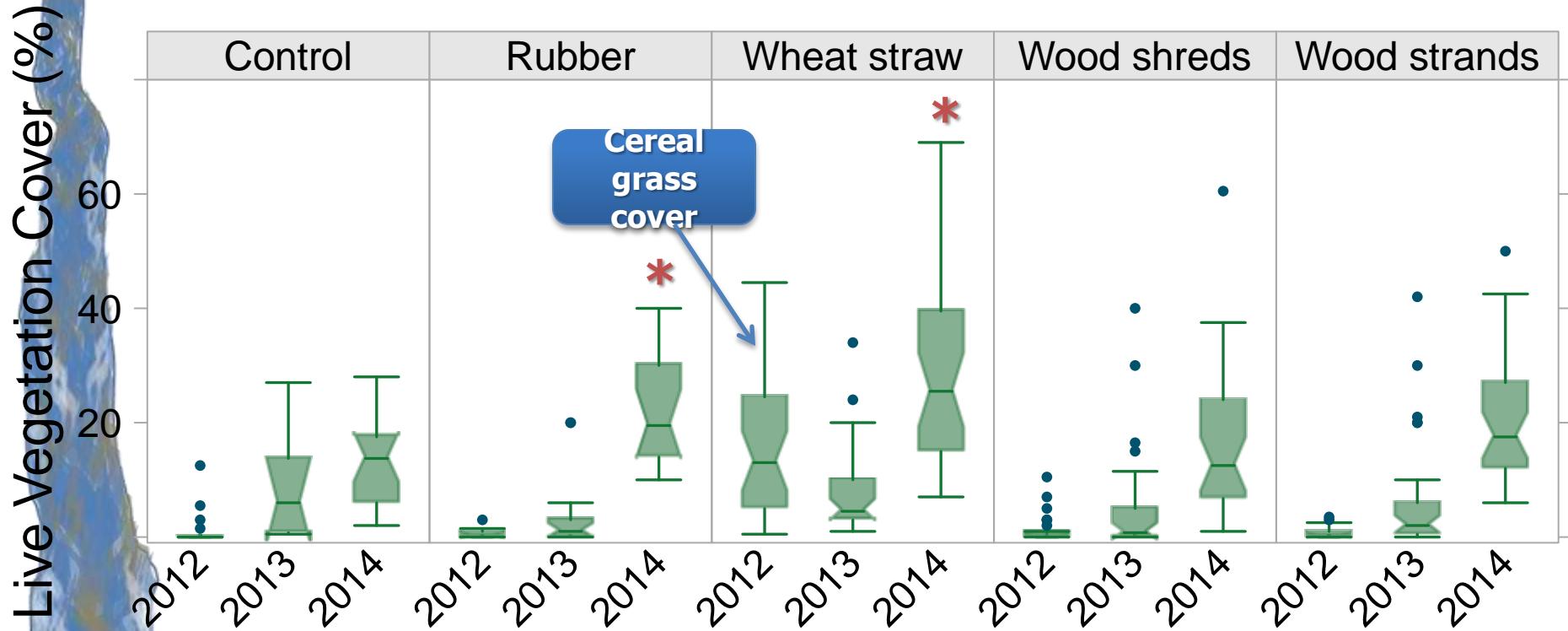
*Indicates significantly ($P<0.05$) lower N than control (all years combined)

MULCH INCREASED SOIL MOISTURE IN 2014



RUBBER AND WHEAT MULCH

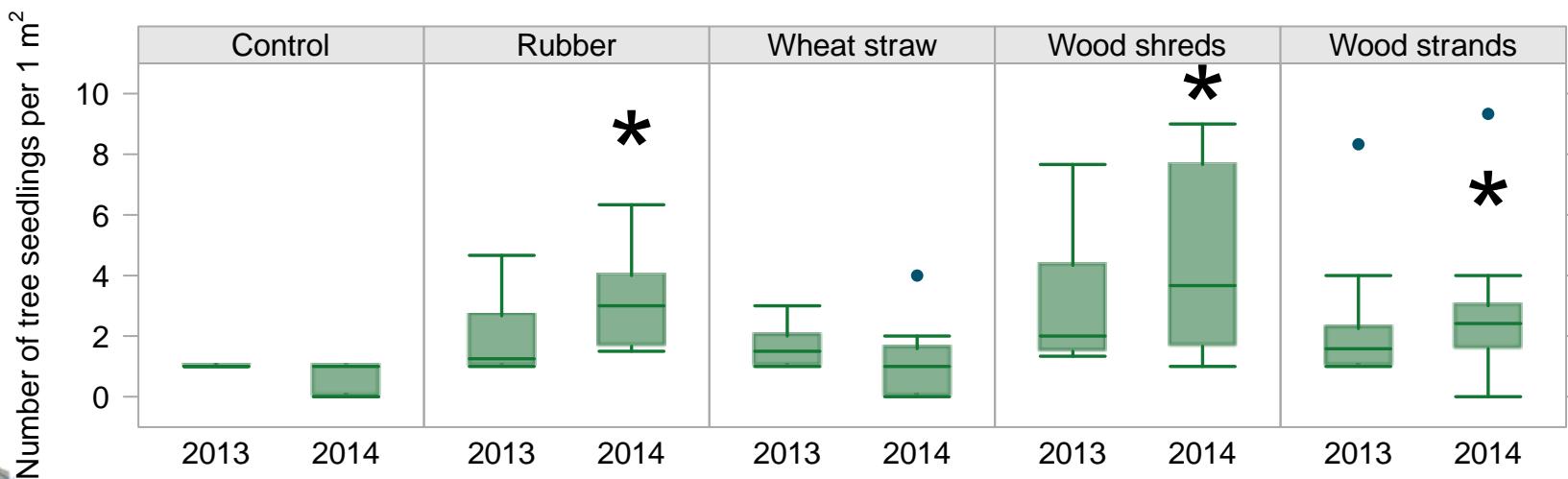
INCREASED LIVE PLANT COVER



*Indicates significantly ($P<0.05$) higher plant cover than control (2014 only).

MULCH INCREASED TREE SEEDLINGS, BUT NOT WHEAT STRAW

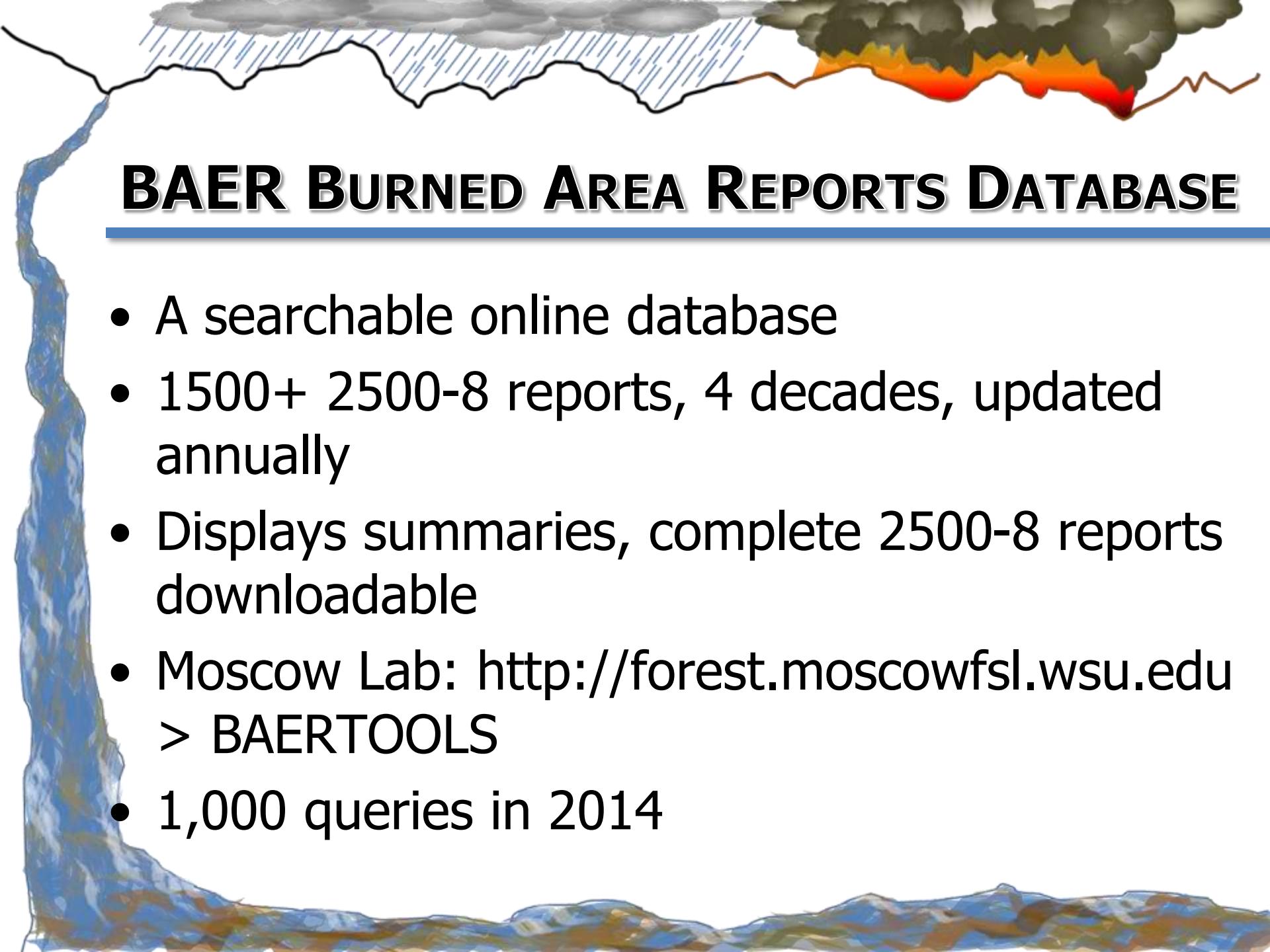
PICO seedlings



*Indicates significantly ($P<0.05$) higher seedling counts than control (2014 only).

HIGH PARK CONCLUSIONS

- Mulch treatments increased soil moisture
- Mulch treatments promoted seedling establishment in year 2
- Wheat straw yielded high plant cover initially compared to other mulches and controls but declining in year 2
- Wheat and wood shreds supports microbial immobilization of soil N, possibly affecting recovering vegetation
- Important to follow through the degradation of wheat mulch to see if effects continue



BAER BURNED AREA REPORTS DATABASE

- A searchable online database
- 1500+ 2500-8 reports, 4 decades, updated annually
- Displays summaries, complete 2500-8 reports downloadable
- Moscow Lab: <http://forest.moscowfsl.wsu.edu>
 > BAERTOOLS
- 1,000 queries in 2014

BAER BURNED AREA REPORTS DATABASE

USDA FOREST SERVICE

[MFSL Home](#) > [BAER Tools](#)

BAER Burned Area Reports DB

BAER Burned Area Reports DB is a database containing post-fire assessment information from four decades of US Forest Service Burned Area Reports. For more information and help, see [BAER Burned Area Reports DB Guide](#).

Select which reports you want:

Location, by: National Forest ▾

[All]
Angeles
Apache-Sitgreaves
Arapaho-Roosevelt
Ashley
Beaverhead-Deerlodge
Bighorn
Bitterroot
Black Hills
Boise

Treatment Types:

[All]
armored ford crossing
channel debris clearing
channel deflectors
contour felling
contour trenching
cross drain ditches
culvert inlet/outlet armoring
culvert maintenance
culvert overflow bypass

From date to (YYYY-MM-DD, or blank)

Choose how to view your reports:

List view

Order by most recent ▾

Show 10 ▾ reports per page

Map view

And finally:

BAER BURNED AREA REPORTS

Found 51 BAER reports with this search:

Forests: [All]

Treatments: [All]

From 2013-01-01 to 2013-12-31

Map View





BAER BURNED AREA REPORTS

List View

Showing reports **1-10** out of **51 selected**, ordered by most recent fire date:

[expand all](#) [shrink all](#) [English units](#)

#	Fire	Forest	Started	Area	Expand
1	Table Rock Fire	Westwide Info (NC, rgn 0)	2013-NOV-12	1,044 ha	expand
2	Rock Creek	Custer (MT, rgn 1)	2013-AUG-20	389 ha	expand
3	Hough Complex	Plumas (CA, rgn 5)	2013-AUG-19	136 ha	expand
4	Lolo Creek Complex	Lolo (MT, rgn 1)	2013-AUG-18	4,412 ha	expand
5	Chestnut Fire	Humboldt And Toiyabe (NV, rgn 4)	2013-AUG-18	1,689 ha	expand
6	Rim Fire	Stanislaus (CA, rgn 5)	2013-AUG-17	103,962 ha	expand
7	Cleghorn	San Bernardino (CA, rgn 5)	2013-AUG-17	45 ha	expand
8	Spring Peak	Humboldt And Toiyabe (NV, rgn 4)	2013-AUG-14	5,759 ha	expand
9	Eureka	Beaverhead-Deerlodge (MT, rgn 1)	2013-AUG-12	2,618 ha	expand
10	Damnation	Flathead (MT, rgn 1)	2013-AUG-11	3,337 ha	expand

[Previous 10 Reports](#)

[Next 10 Reports](#)

Go to report #: of 51

BAER BURNED AREA REPORTS

TOTAL EXPENDITURE FOR HILLSLOPE TREATMENTS IN MILLIONS OF \$USD

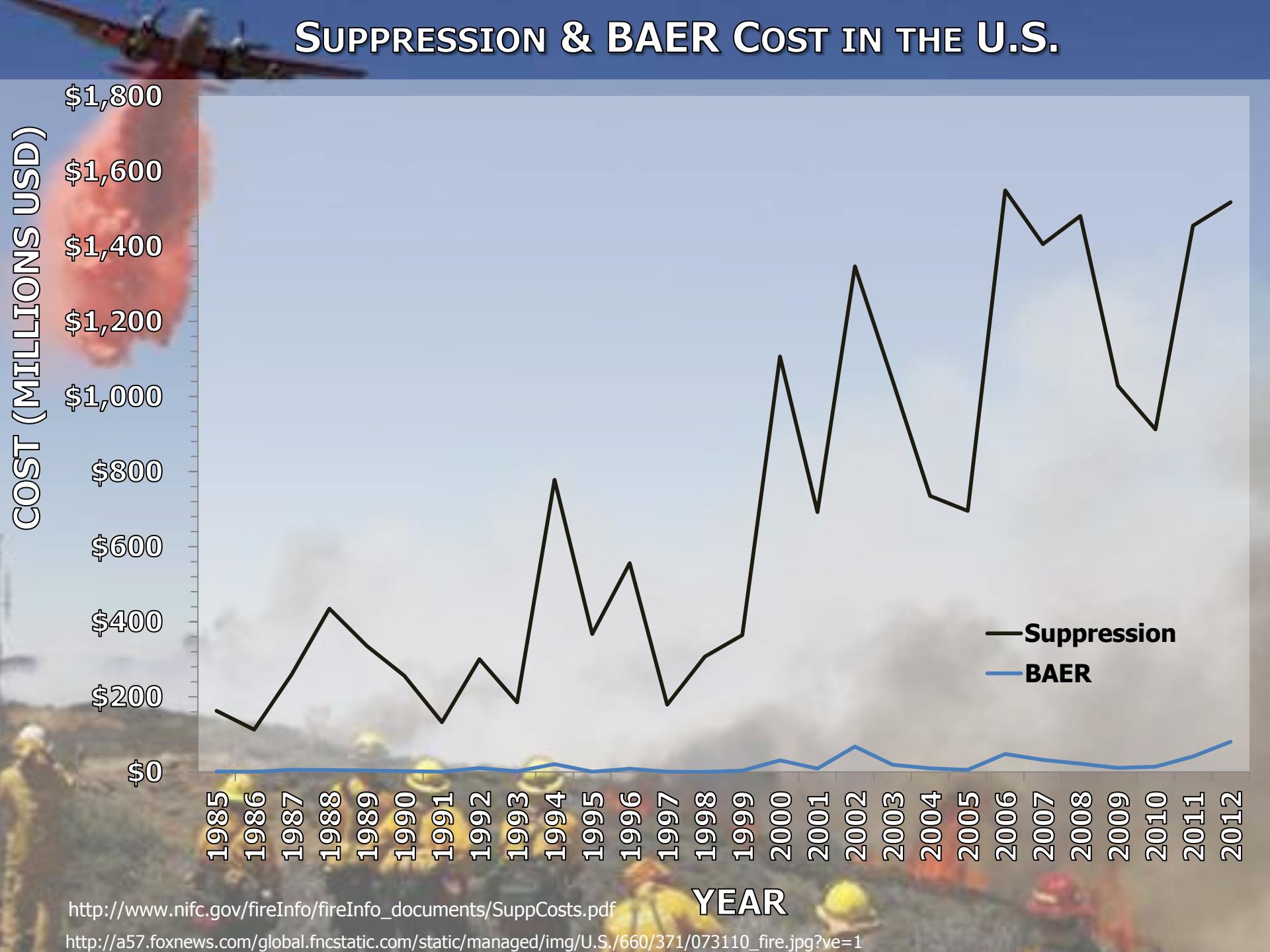
Treatment category ^a	Decade			
	1970s	1980s	1990s	2000s
Seeding	3.5	13.5	12	21
Fertilizer and seeding	2	3	1.3	1.4
Contour felled logs	0.2	6	29	8
Agricultural straw mulch	<0.1	0.2	3	80
Hydromulch	n.a.	n.a.	n.a.	41
Wood strand mulch	n.a.	n.a.	n.a.	3

10 FIRES ON USFS LANDS WITH LARGEST EXPENDITURES

BAER Expenditure				Suppression Expenditure			
Fire name	State	Yr	Expenditure Millions (\$)	Fire Name	State	Yr	Expenditure Millions (\$)
Tripod Complex	WA	2006	30	Biscuit	OR	2002	153
Hayman	CO	2002	25	Klamath	CA	2007	126
Cerro Grande	NM	2000	15	Zaca Two	CA	2008	122
Rodeo/Chediski Complex	AZ	2002	13	Wallow	AZ	2011	109
Foothills	ID	1992	13	Station	CA	2009	96
Rabbit Creek	ID	1994	12	Lightning Complex	CA	2008	95
Valley-Skalkaho Complex	MT	2000	12	Basin Complex	CA	2008	78
Biscuit	OR	2002	11	Day	CA	2006	78
Tyee Creek Complex	WA	1994	9	Iron & Alps Complex	CA	2008	74
Gap	CA	2008	7	Tripod Complex	WA	2006	68

Robichaud, P.R.; Rhee, H.; Lewis, S.A. 2014 *A synthesis of post-fire Burned Area Reports from 1972 to 2009 . . . Int. J. of Wildland Fire* 2014, 23, 929–944.

SUPPRESSION & BAER COST IN THE U.S.





<http://forest.moscowfsl.wsu.edu/fswepp/>



Forest Service WEPP Interfaces

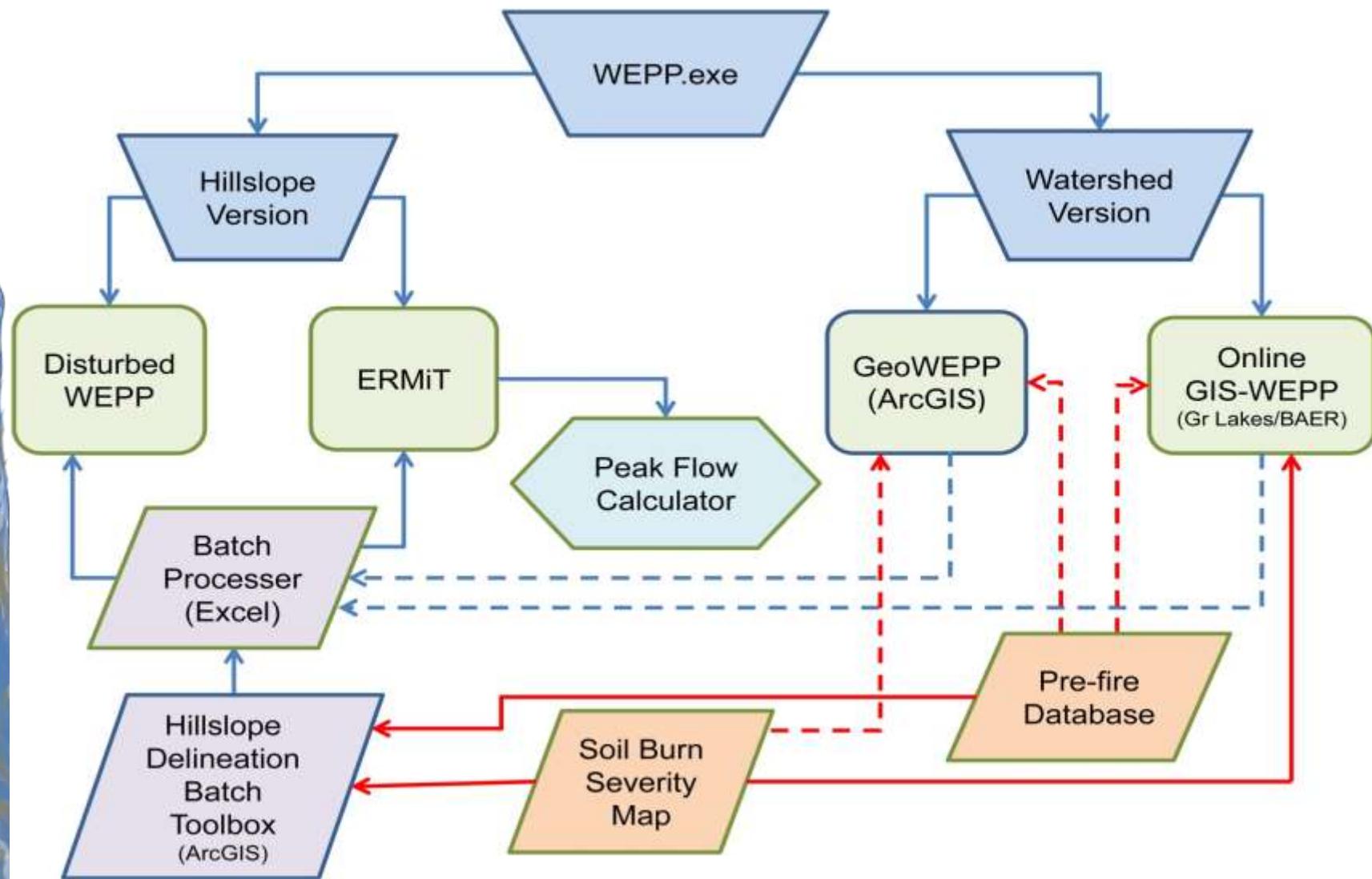


	WEPP:Road 1989 runs YTD	WEPP:Road Batch 277 runs, 5478 segments YTD	
	ERMiT 1732 runs YTD	ERMiT batch (download) 43 runs YTD	
	Disturbed WEPP 4643 runs YTD	Disturbed WEPP batch (download) 206 runs YTD	
	Tahoe Basin Sediment Model 863 runs YTD	Biomass Sediment Model 43 runs YTD	
	FuME (Fuel Management) 210 runs YTD	Rock:Clime	
	WEPP Watershed Online GIS	Peak Flow Calculator	
	Water And Sediment Predictor Under development	Other WEPP resources	

Units: metric U.S. customary

[personality](#) (a to z)

WEPP Models



MAPPING PREDICTION VAR TREATMENTS

User Input

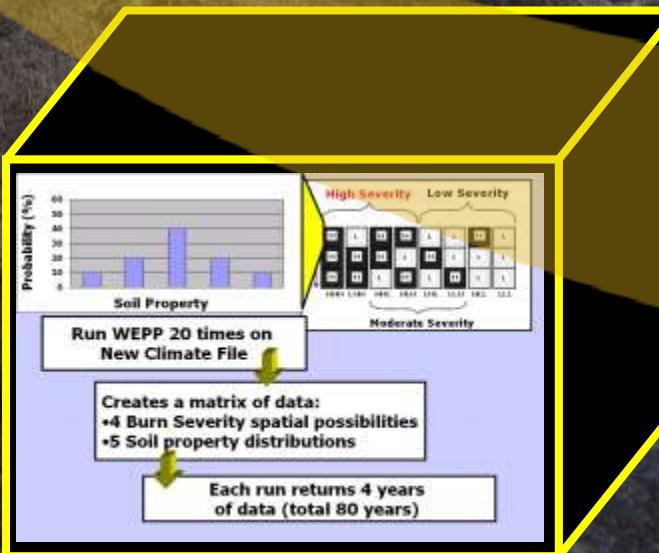
The screenshot shows the ERMIT software interface with various input fields:

- Climate:** Includes dropdown menus for "STEVENSON MT", "Kalamata, Greece ++", "CHEESMAN CO", "Kalamata, Greece ++", "Kalamata, Greece ++", "DENVER WB AP CO", and "MOUNT SHASTA CA". A "Custom Climate" button is also present.
- Soil Texture:** Options include clay loam, silt loam, sandy loam, loam, and a "Rock content" field set at 20%.
- Vegetation type:** Set to "Range Chaparral".
- Hillslope gradient:** Top (0%), Middle (50%), Toe (30%).
- Hillslope horizontal length:** 100 m.
- Soil burn severity class:** Radio buttons for High, Moderate, and Low.
- Rangelchaparral pre-fire community description:** Includes "% shrub" (yellow), "% grass" (green), and "% bare" (pink).
- Run ERMIT** button at the bottom.

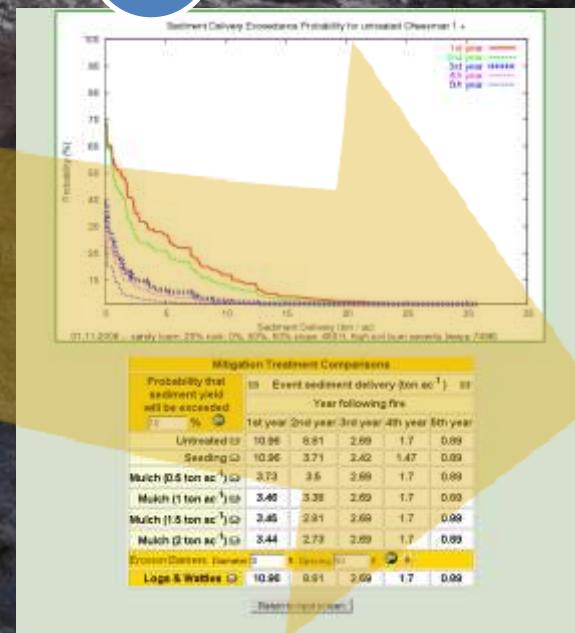
ERMiT

- Event based
- Probabilistic
- Incorporates Variability

Calculations



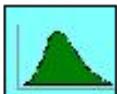
Output



Sediment Delivery

Probability that sediment yield will be exceeded	Event sediment delivery (ton ac^{-1})				
	Year following fire				
	1st year	2nd year	3rd year	4th year	5th year
Untreated	6.37	2.64	0.69	0.28	0.01
Seeding	6.37	0.89	0.36	0.15	0.01
Mulch (0.5 ton ac^{-1})	1.11	0.87	0.69	0.28	0.01
Mulch (1 ton ac^{-1})	0.37	0.63	0.69	0.28	0.01
Mulch (1.5 ton ac^{-1})	0.03	0.61	0.69	0.28	0.01
Mulch (2 ton ac^{-1})	0.02	0.44	0.69	0.28	0.01
Erosion Barriers: Diameter	0.8	ft	Spacing	60	ft
Logs & Wattles	2.6		0.35	0	0

[Return to input screen](#)

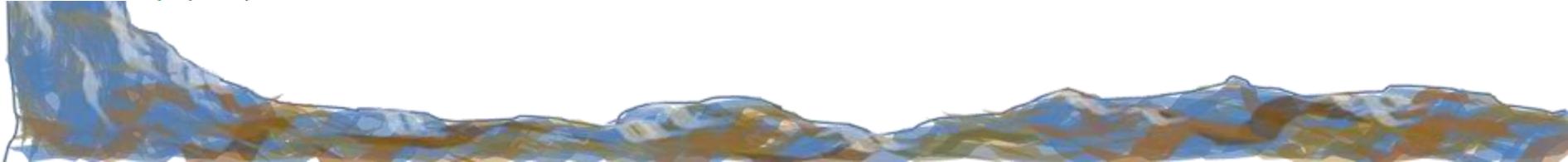


Forest Service Peak Flow Calculator

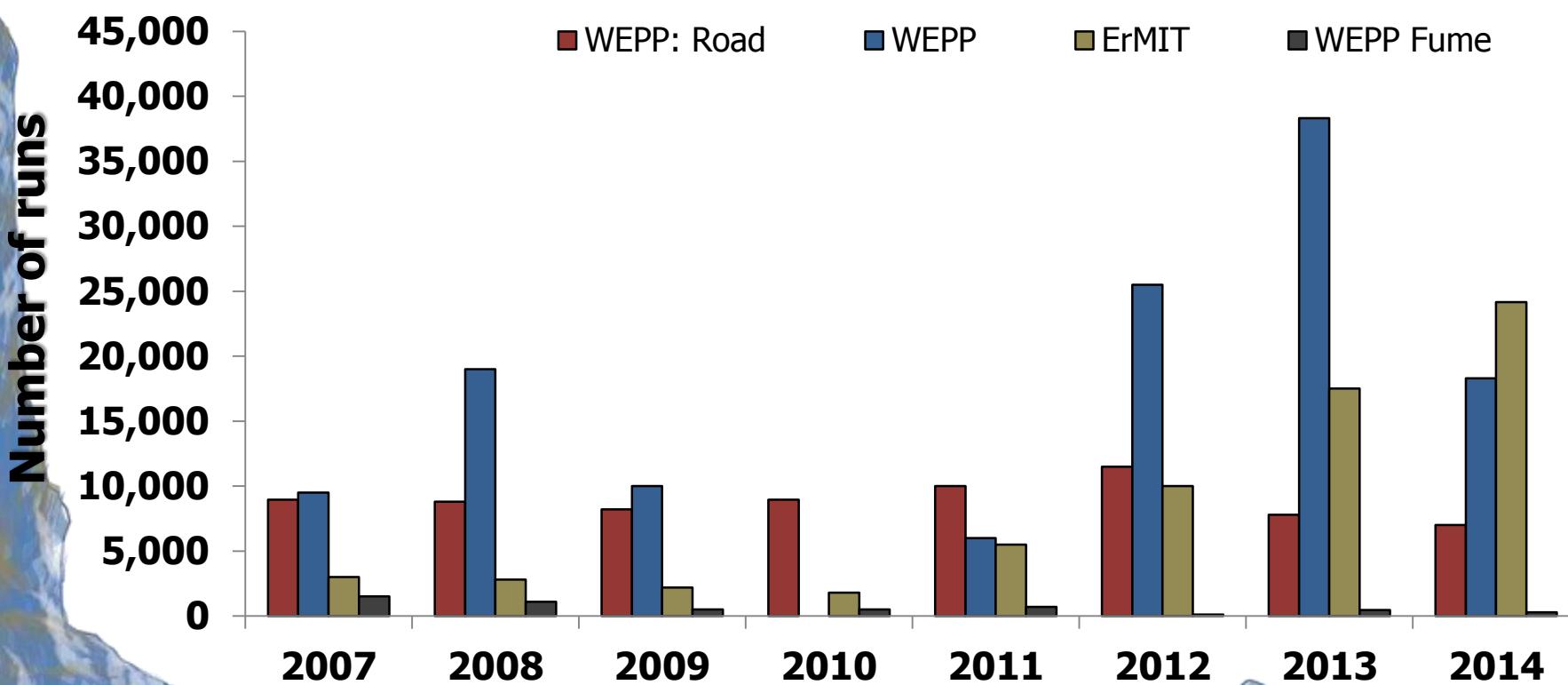
Estimated peak flow for burned areas using Curve Number technology

[Manual entry](#)[From ERMiT](#)[From WEPP Online GIS](#)

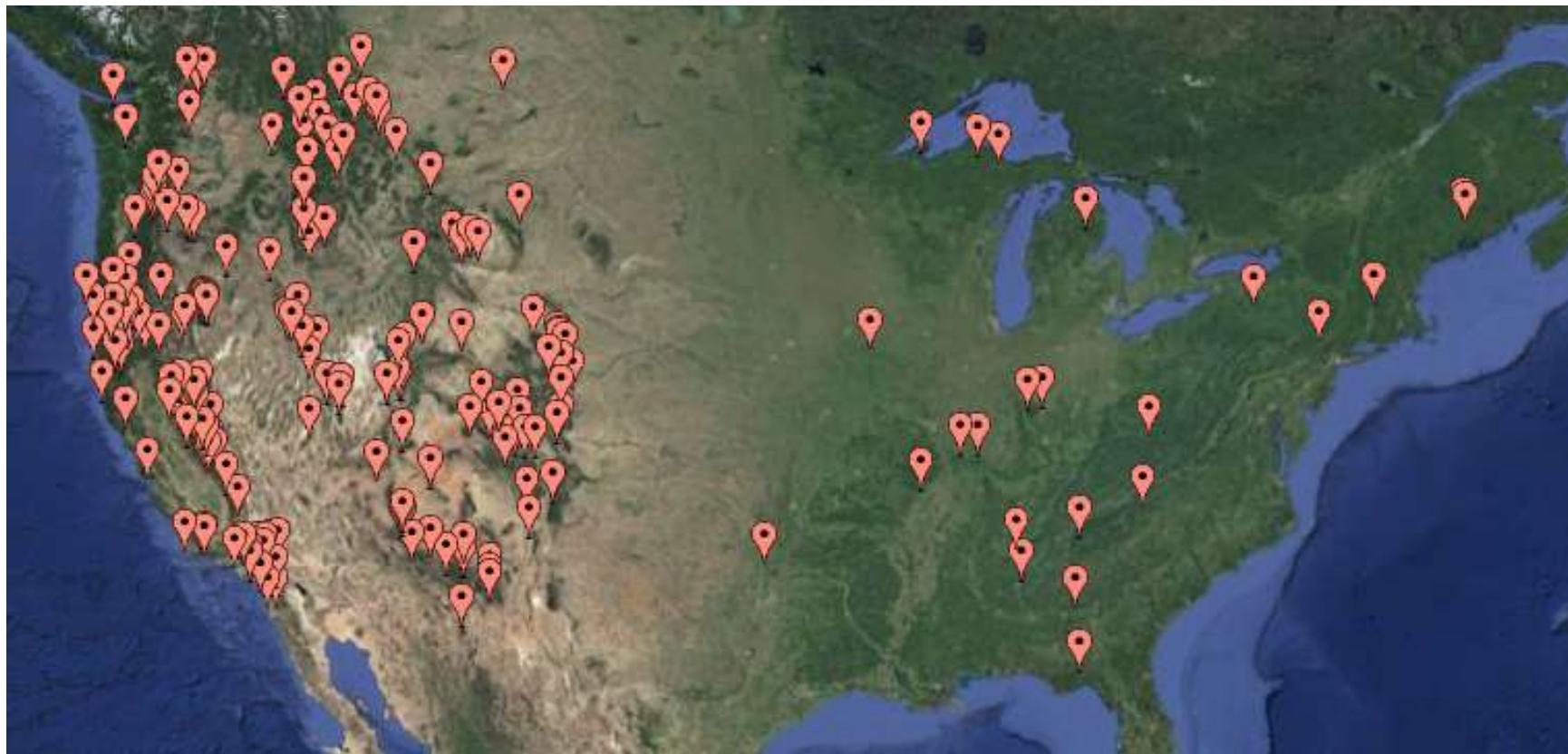
Run Description	Levan Fire Watershed 3		
Storm runoff, Q	17.5	mm	0.69 in
Storm precipitation, P	33.3	mm	1.31 in if $Q > P$ use $P \sim 2 Q$
Watershed area, A	155.8	ha	385 ac
Watershed flow length, L	3011.9	m	9882 ft
Avg watershed gradient, Sg	0.14	m/m	0.14 ft/ft
Curve number, CN	93		93 CN estimate from ERMiT: 93 (forest)
Time of concentration, T_c	.55	hr	.55 hr $T_c \sim 0.55$ hr (flat watershed; dry soil)
Ponding adjustment factor, F_p	1		1 × 0% pond: 1.0; 1.0%: 0.87; 5.0%: 0.72
RESULTS			
Surface storage, S	19	mm	0.75 in
Initial abstraction, I_a	3.8	mm	0.15 in
I_a/P	0.11		0.11
Unit peak flow rate, q_u	2.08	m^3/s per ha/mm $\times 10^{-3}$	1.1702 ft^3/s per acre/in $\times 10^{-3}$
Estimated peak flow rate, q	5.67	m^3/s	go 200.21 ft^3/s view log add to log delete log
Culvert diameter, D	151.57	cm	go 59.67 in h 2.0 m 6.6 ft

[use Mica Creek example](#) | [clear](#) |

FS WEPP Model	2014	FS WEPP Model	2014
<i>WEPP:Road</i>	7,012	<i>ERMIT</i>	24,153
<i>WEPP: Road Batch</i>	499	<i>ERMiT Batch</i>	280
<i>Disturbed WEPP 2.0</i>	18,289	<i>WEPP FuME</i>	280
<i>Disturbed WEPP Batch</i>	119	<i>Tahoe Basin</i>	492



ERMiT runs



+ 100's of international locations



GEO-WEPP (ARC GIS)

Burned Area Emergency Response
Spatial WEPP Model Inputs Generator

Spatial WEPP Products Static Files

Draw Burned Area Extent on the Map
 Draw Selection on Map

Or, Select an MTBS Fire
Select an MTBS fire: BOBCAT
 Burn land cover and soil layers by MTBS fire

Or, Use a Custom BARC Map
 Upload a New BARC Map Use My Private Key

Products: Land cover and linkage files
 Soils and linkage files
 Digital elevation model (DEM)

File format: ASCII Grid (*.asc)
 Download ZIP Archive Add to Download

Download Queue

ROI	Filename	File Format	Link
BOBCAT	landcov.txt		Download
BOBCAT	landusedb.txt		Download
BOBCAT	soilsdb.txt		Download
BOBCAT	soilsmap.txt		Download
BOBCAT	dem.asc	ASCII Grid (...	Download
BOBCAT	landcov.asc	ASCII Grid (...	Download
BOBCAT	soil.asc	ASCII Grid (...	Download

Clear Downloads

Help Locate Me on Map Show available data on map

UNITED STATES

Cheyenne Denver Colorado River Arkansas River

Michigan Tech Research Institute

A cartoon illustration of a brown bear wearing a white NASA space suit with a blue helmet. The bear is holding a small silver device or tool in its right paw. The background behind the bear is a dark, textured area.

GEO-WEPP (ARC GIS) PRE-LOAD

- Soils: USDA SSURGO and STATSGO datasets
- Land cover: Existing Vegetation Type LANDFIRE
- DEM USGS Seamless Data Warehouse
- Add Soil Burn Severity Map

GEO-WEPP (ARC GIS)

ArcGeoWEPP.mxd - ArcMap - ArcInfo

File Edit View Bookmarks Insert Selection Tools Window Help

Spatial Analyst Layer: network Editor Task: Create New Feature Target:

Network Layer Properties

- network
- Channel
- subcatchments
- Value
 - High : 384
 - Low : 22
- landcov
- All Data Values
 - Water
 - Developed - Low
 - Developed-Roads
 - Barren
 - Forest
 - Short Grass
 - Tall Grass
 - Shrub
 - Pasture/Hay
 - Cultivated Crops
 - Wetlands
 - Barren
 - Low Burn Severity
 - Low Burn Severity
 - Low Burn Severity
 - Moderate Burn Severity
 - Moderate Burn Severity
 - High Burn Severity
 - High Burn Severity
 - High Burn Severity
- soils
- hillshade
- dem

Display Source Selection Favorites Index Search Results

Drawing A Arial 10 B I U A

WEPP Management and Soil Lookup

Area	GIS Soil	WEPP Soil
0.0%	s_659495300	CO_DisturbedWEPPs_659495300.sol
0.0%	s_497691300	CO_DisturbedWEPPs_497691300.sol
0.0%	s_659565300	CO_DisturbedWEPPs_659565300.sol
0.1%	s_497752000	CO_DisturbedWEPPs_497752000.sol
0.2%	s_659565000	CO_DisturbedWEPPs_659565000.sol
0.2%	s_762958000	CO_DisturbedWEPPs_762958000.sol
0.3%	s_762962000	CO_DisturbedWEPPs_762962000.sol

Landuse Soils Channels

To run a WEPP simulation the landuse and soils defined in the GIS must be associated with equivalent WEPP inputs. Double-click on any entry in the WEPP management or soils columns to display a list of WEPP inputs that may be used. Where no WEPP management or soil is specified the default soil or management will be used.

OK Cancel

WEPP Management and Soil Lookup

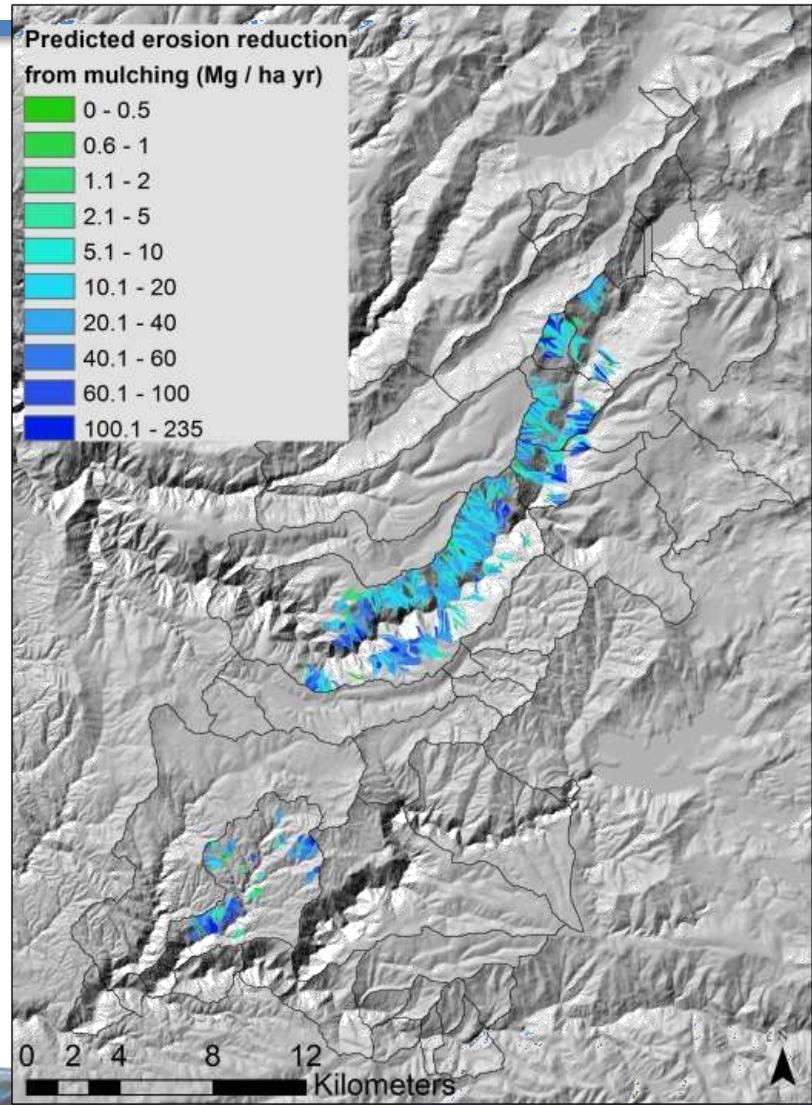
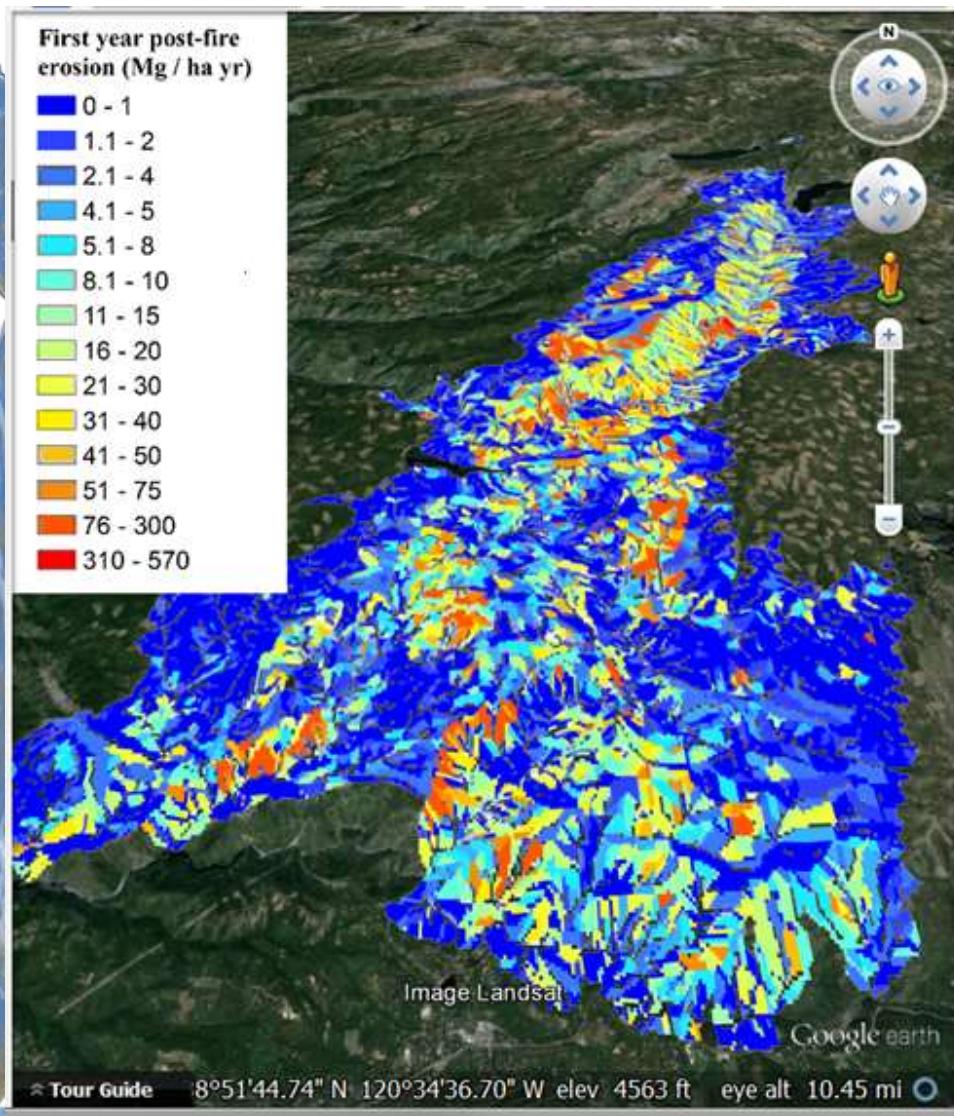
Area	GIS Landuse	WEPP Management
0.0%	High Burn Severity	GeoWEPP<25% cover-high severity burn.rot
0.0%	Low Burn Severity	GeoWEPP<90% cover-low severity burn.rot
0.1%	Moderate Burn Severity	GeoWEPP<45% cover-moderate severity bur...
0.6%	Tall Grass	Forest\Disturbed WEPP Management\Tall gr...
0.7%	Low Burn Severity	GeoWEPP<90% cover-low severity burn.rot
1.4%	Short Grass	Forest\Disturbed WEPP Management\Short ...
13.3%	Forest	Forest\Disturbed WEPP Management\Forest...
19.8%	Low Burn Severity	GeoWEPP<90% cover-low severity burn.rot
27.2%	High Burn Severity	GeoWEPP<25% cover-high severity burn.rot
36.8%	Moderate Burn Severity	GeoWEPP<45% cover-moderate severity bur...

Landuse Soils Channels

To run a WEPP simulation the landuse and soils defined in the GIS must be associated with equivalent WEPP inputs. Double-click on any entry in the WEPP management or soils columns to display a list of WEPP inputs that may be used. Where no WEPP management or soil is specified the default soil or management will be used.

OK Cancel

GEO-WEPP (ARC GIS): KING FIRE



ONLINE GIS WEPP: INPUT

WEPP Watershed
Online GIS Interface

September 2011

Mapping (Rim) Projects Help

Double-click to zoom in, and drag to pan. Hold down the shift key and drag to zoom to a particular region.

Zoom to Zip Code or City, State: Go Example: Pullman WA or -117 1819 46 7298

Google

lon=-120.0932 lat=37.8770 elev=???

Map data ©2015 Google Terms of Use Report a map error

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Forest Rte 110X

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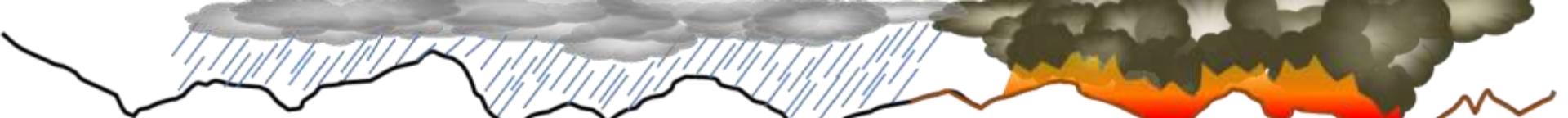
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lon=-120.0932 lat=37.8770 elev=???

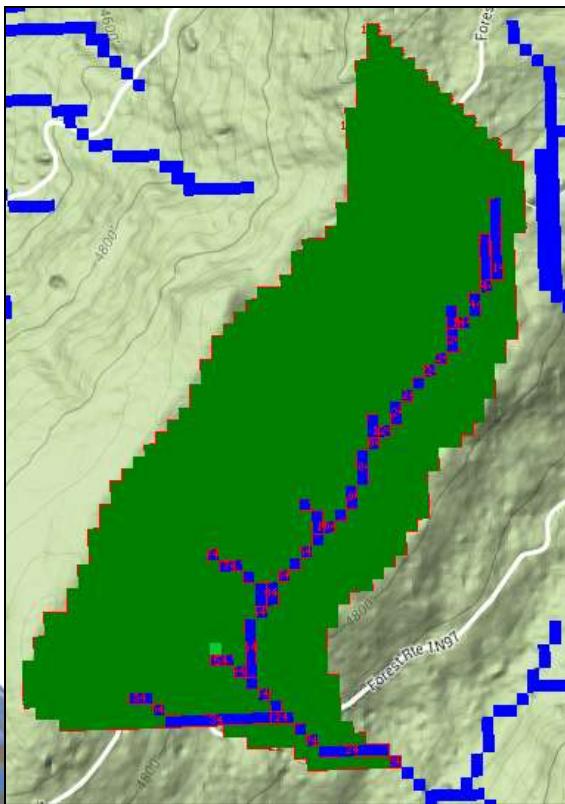
Map data ©2015 Google Terms of Use Report a map error

- 
- Soil Loss 0 - 1.25 t/ha/yr
 - Soil Loss 1.25 - 2.5 t/ha/yr
 - Soil Loss 2.5 - 3.75 t/ha/yr
 - Soil Loss 3.75 - 5 t/ha/yr
 - Soil Loss 5 - 10 t/ha/yr
 - Soil Loss 10 - 15 t/ha/yr

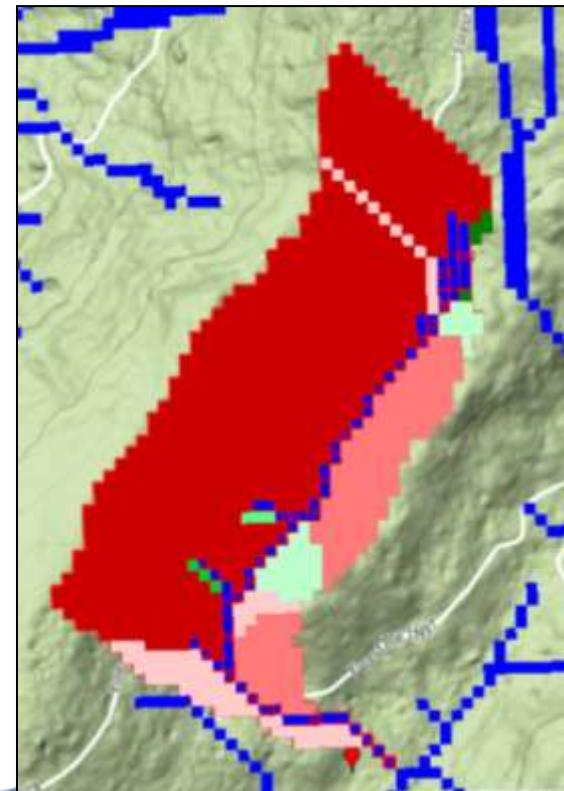
Online GIS WEPP:

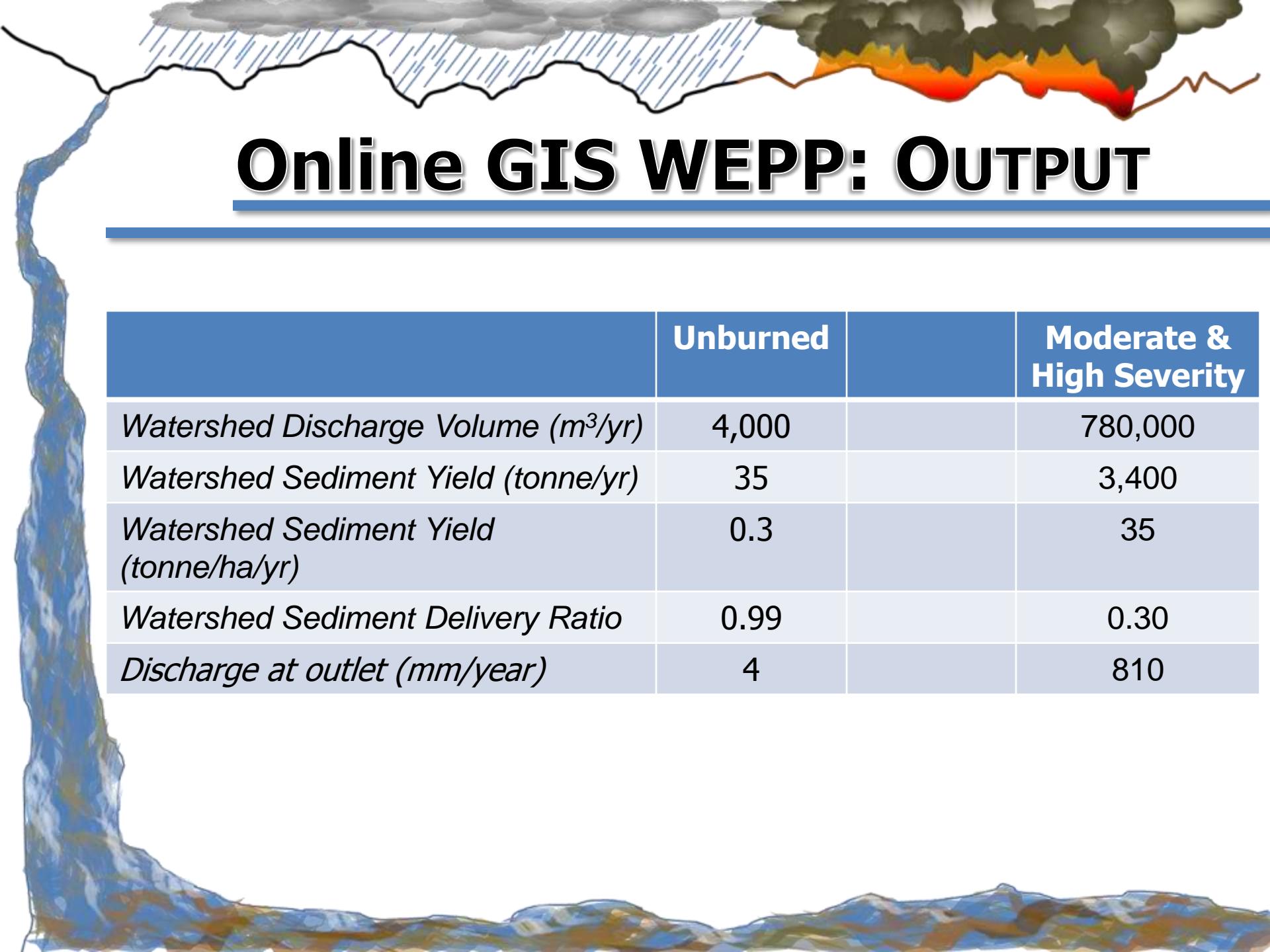
MAP OUTPUT

Unburned



High severity





Online GIS WEPP: OUTPUT

	Unburned		Moderate & High Severity
<i>Watershed Discharge Volume (m³/yr)</i>	4,000		780,000
<i>Watershed Sediment Yield (tonne/yr)</i>	35		3,400
<i>Watershed Sediment Yield (tonne/ha/yr)</i>	0.3		35
<i>Watershed Sediment Delivery Ratio</i>	0.99		0.30
<i>Discharge at outlet (mm/year)</i>	4		810

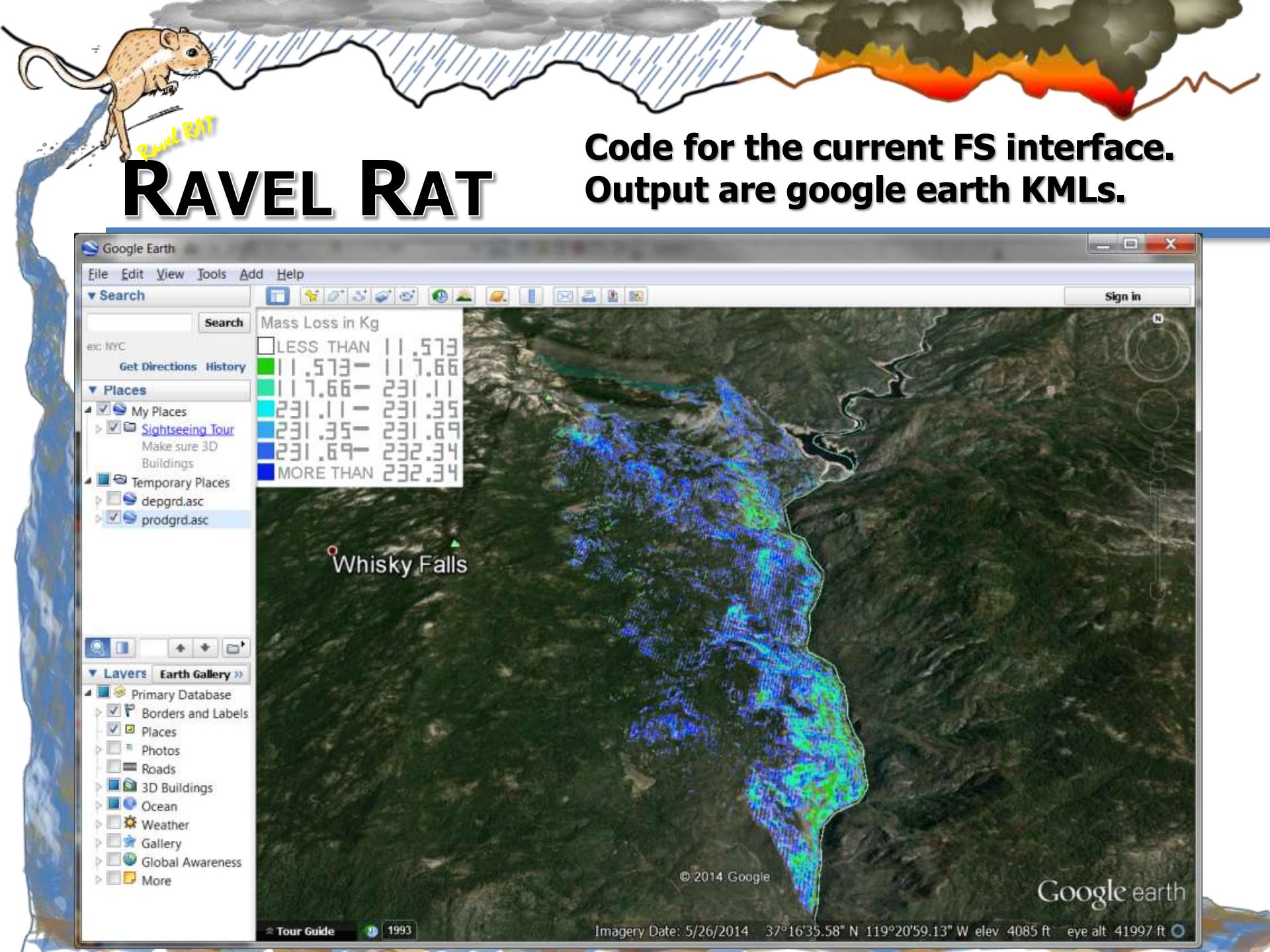
Online GIS WEPP : OUTPUT

10 YEAR SIMULATION FOR WATERSHED

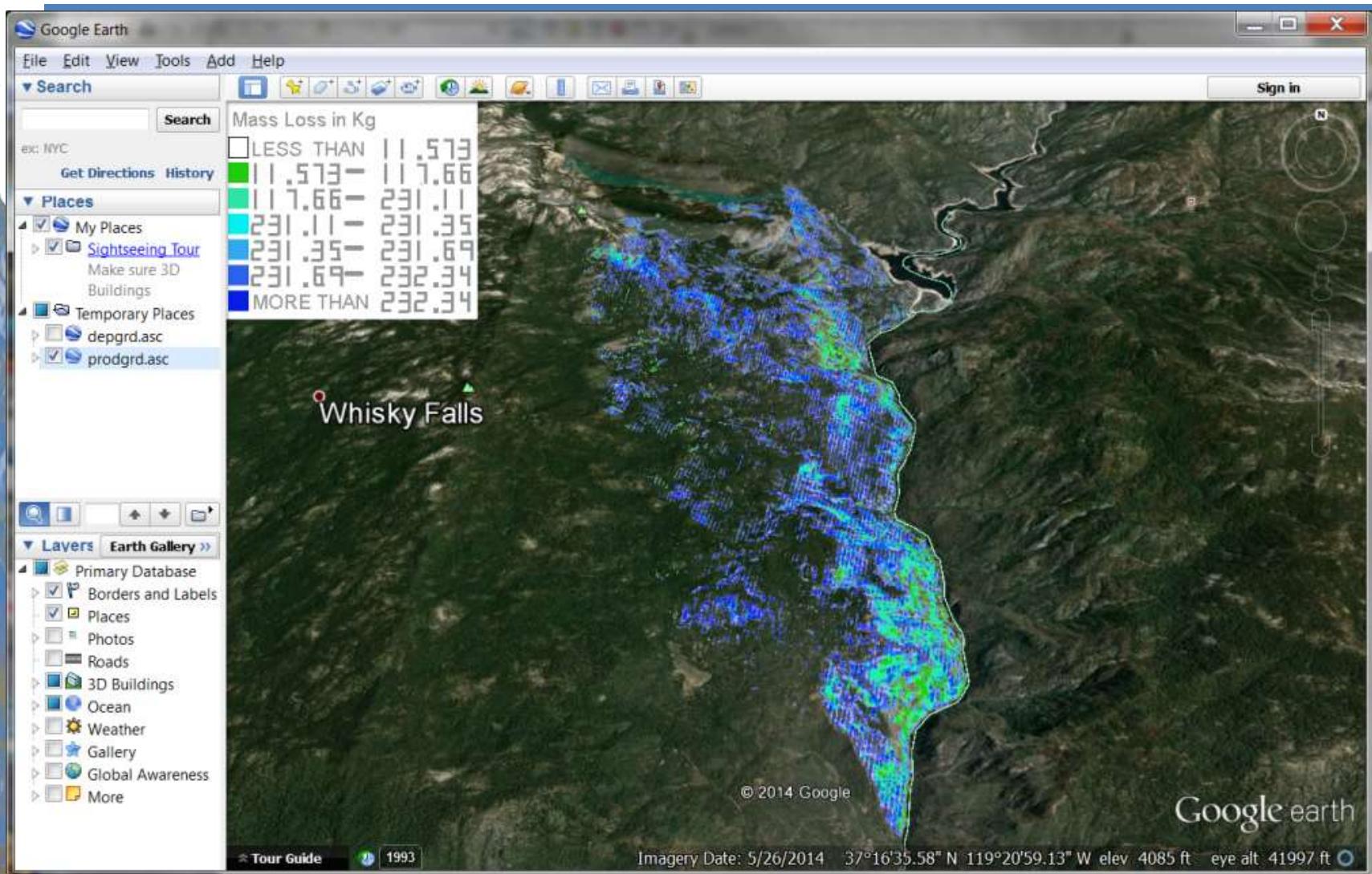
Number of events: 3600

Return Period of SEDIMENT YIELD by Event

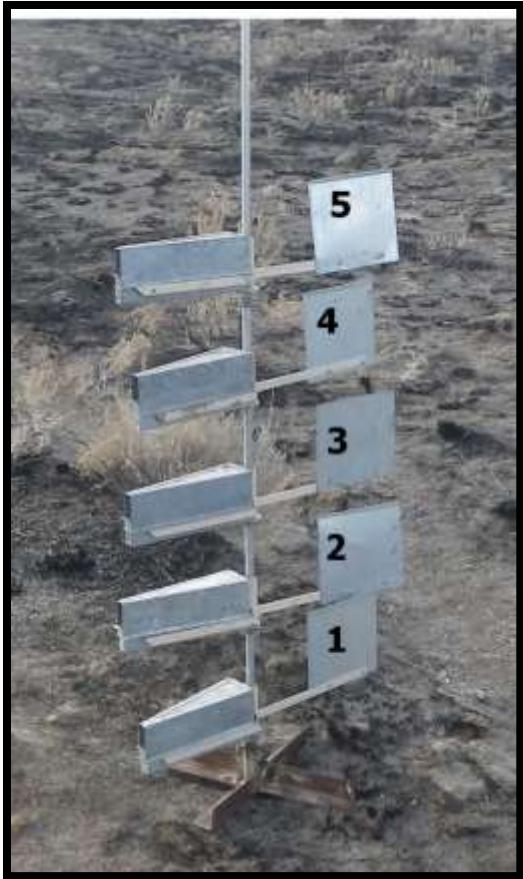
Model	Recurrence Interval years	Day	Month	Year	Precip (mm)	Runoff (m³)	Peak (m³/s)	Sediment Yield (kg)
Unburned	2	29	1	3	41	171	0.1	4,000
	5	9	2	7	72	2350	0.9	36,000
High Severity	2	8	3	1	25	55,000	15	670,000
	5	12	2	5	80	95,000	25	800,000



**Code for the current FS interface.
Output are google earth KMLs.**

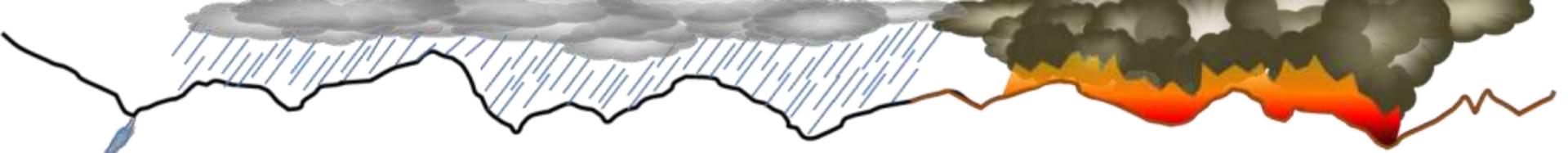


POST-FIRE WIND EROSION MONITORING BLM IDAHO



- **2014 Preacher Fire**
 - BSNE, PM10, PM2.5
 - Weather station





Alone we can do so little...



Together we can do so much! –Helen Keller

<http://forest.moscowfsl.wsu.edu>